

# ROD AMENDMENT

## SUPPORTING DOCUMENTATION

PURITY OIL SALES SUPERFUND SITE  
FRESNO, CALIFORNIA

JULY 2005

**DRAFT MEETING AGENDA  
PURITY OIL SALES SUPERFUND SITE  
FRESNO, CALIFORNIA  
JULY 14, 2005**

- I. RAWP:
  - a. Waste Neutralization - Specifications (Treatment objectives – QA/QC Testing, placement of deleterious material, and placement/compaction of treated waste – QA/QC Testing)
  - b. Impermeable Cap
    - 1. 6-inch Cushion Layer – Specifications (Installation Procedures), QA/QC Requirements (Testing, Gradation, etc.)
    - 2. Geosynthetic Clay Liner (GCL) – Specifications (Manufacturer, QA/QC, Installation and Field Testing), Installation/Field QA/QC
    - 3. 2-foot Vegetative Layer – Specifications (Design Criteria ((promote vegetative growth)), State and/or Federal DOT Compliance, Additives (Fertilizer, pH adjustment, etc.), Placement/compaction requirements
    - 4. Grass/Seeding – Specifications (Design Criteria ((Cooperative Extension/Ag Dept. recommendations))
  - c. RAWP Drawings
    - 1. Site Map
    - 2. Area to be Neutralized
    - 3. Final Waste Grading Plan (Final elevation)
    - 4. Cross-Section of Waste Layer/Impermeable Cap (Detail Drawings)
    - 5. Final Grading Plan (Final elevations)
    - 6. Drainage Feature/Surface Water Control Features (Location, size, flow diagram, etc.)
    - 7. SVE System Design Drawings (Location, Piping and Wellhead Details, Process Flow Diagram, etc.)

## MEMORANDUM

**To:** File

**From:** Tetra Tech EMI

**Date:** July 14, 2005

**Subject:** Impermeable Cap Components  
Purity Oil Sales Superfund Site  
Fresno, California

On July 14, 2005, a conference call was held to discuss the Impermeable Cap components for the Remedial Action of the Purity Oil Sales Superfund Site. The following people were present on the conference call:

Rose Marie Caraway	U.S. Environmental Protection Agency (EPA)
Ed Bates	U.S. Environmental Protection Agency (EPA)
Mark Lewis	Tetra Tech EM Inc.(Tetra Tech)

The purpose of the meeting was to discuss the impermeable cap components, and what other information EPA would need for the Remedial Action Work Plan (RAWP) associated with the Remedial Action of the Purity Oil Sales Superfund Site. The following is a summary of items discussed:

- SECOR is concerned that utilizing drainage net in the impermeable cap could create a failure plane or slip plane on the side slopes (see attached email from SECOR). EPA stated that they do not feel that the drainage net is totally necessary, however, precipitation flow (surface water control) is very important. EPA is concerned that precipitation will infiltrate (percolate) into vegetative layer and contact the GCL.
- EPA wants SECOR to address infiltration and water management: (1)infiltration modeling, (2) surface water control, (3) surface water conveyance system, etc. EPA wants SECOR to provide assurance/confirmation that infiltration and surface water control will be addressed (with design calculations).
- EPA wants SECOR to provide drawing showing location of SVE wells that will penetrate the impermeable cap components and location of SVE conveyance pipe. EPA wants SVE conveyance pipe installed above GCL.

cc: Rose Marie Caraway, EPA Remedial Project Manager  
Ross Berman, Tetra Tech Project Manager  
File

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From : Dave Miller &lt;drmill@secor.com&gt;

[Inbox](#)

Sent : Thursday, July 14, 2005 7:06 AM

To : &lt;ttemiwest@hotmail.com&gt;

CC : "Jim Burns" &lt;jburns@secor.com&gt;, "Gary Ackerman" &lt;gackerman@secor.com&gt;, "Tom Peet" &lt;tpeet@secor.com&gt;

Subject : Purity Cap Design

Mark,

Based on our conversation on Wednesday, I reviewed SECOR's latest cap design for the Purity site and determined that the cap proposed in January 2004, consists of a 6-inch cushion layer, a GCL and 2-feet of vegetative fill material. The design did not include a drainage layer. You noted that the selected alternative in the April 2005 EPA Proposed Plan includes a drainage layer (geosynthetic or gravel) above the GCL, and wanted SECOR's justification for removing the drainage layer.

The January 2004 cap design was based on the EPA's Alternative 7 from August 2002 (attached). The EPA's proposed alternative did not include a drainage layer above the GCL. SECOR evaluated EPA's Alternative 7 and agreed that this design was appropriate and effective and did not need a drainage layer to be added. This decision was based primarily on the fact that the material beneath the cap would now be stabilized and compacted near the optimum moisture content, and that the cap would be vegetated and contoured to facilitate runoff to the perimeter and limit infiltration.

In addition, SECOR noted that the use of a drainage layer could produce a slip-plane on the steeper side slopes of the cap. The GCL can swell when it gets wet, and the manufacturer recommends 2-feet of soil be placed above the GCL to provide an equal confining pressure across the GCL. By placing gravel or a geosynthetic layer above the GCL, the normal confining pressure will be concentrated on multiple point loads. This could allow the GCL to swell into void spaced between the point loads and create a slip-plane.

If you have any questions, please contact me at (517) 349-9499 ext. 227.

**David R. Miller, P.E.**

Associate Engineer

SECOR International Inc.

2321 Club Meridian Drive, Suite E



**FINAL RECORD OF DECISION AMENDMENT  
FOR OPERABLE UNIT 1 REMEDIAL ACTIONS**



**U.S. DEPARTMENT OF ENERGY**

**FERNALD CLOSURE PROJECT  
FERNALD, OHIO**

**OCTOBER 2003**

**10500-RP-0018  
Revision 0, Final**

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## AMENDMENT TO THE OPERABLE UNIT 1 ROD DECLARATION

### SITE NAME AND LOCATION

U.S. Department of Energy  
Fernald Environmental Management Project, Operable Unit 1  
Hamilton and Butler Counties, Ohio  
Cincinnati, Ohio

### STATEMENT OF BASIS AND PURPOSE

This decision document amends the selected remedial action for the Fernald Environmental Management Project – Operable Unit 1 in accordance with Section 117(c) of the Comprehensive Environmental Response, Compensation and Liability Act, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) (hereinafter jointly referred to as CERCLA), 42 USC §9617(c), and 40 CFR§300.435(c)(2)(ii). This Amendment has been prepared to document the nature of the change made to the selected remedy identified in the January 1995 Final Operable Unit 1 Record of Decision (ROD).

This Amendment to the Record of Decision (ROD Amendment) does not make “fundamental changes” (within the meaning of the Environmental Protection Agency’s Office of Solid Waste and Emergency Response Directive 9355.3-02FS-4, ‘Guide to Addressing Pre-ROD and Post ROD Changes’, April 1992) to the key components of the remedial action. However, the ROD Amendment does document disposition of contaminated cap materials; provides for adjustment of soil remediation levels as allowed for in the original ROD; modifies the final cover and provides clarification on terminology.

The ROD Amendment will be incorporated into the Fernald Environmental Management Project Administrative Record which is available at the Public Environmental Information Center (PEIC), located in Trailer 210 at the Fernald Closure Project, 7400 Willey Road, Hamilton, Ohio, 45013-9402, (513) 648-7480.

The State of Ohio, through the Ohio Environmental Protection Agency (Ohio EPA), has concurred with the amended remedy.

## ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this operable unit, if not addressed by implementing the response action selected in the Operable Unit 1 ROD and this ROD Amendment, may present an imminent and substantial endangerment to the public health, welfare, and/or the environment.

## DESCRIPTION OF THE 1995 OPERABLE UNIT 1 ROD REMEDY

The Operable Unit 1 remedy is: removal, treatment, and off-site disposal at a permitted commercial disposal facility. The Operable Unit 1 ROD consists of the following key components:

1. Construction of waste processing and loading facilities and equipment.
2. Removal of water from open waste pits for treatment at the site's wastewater treatment facility.
3. Removal of waste pit contents, caps and liners, and excavation of surrounding contaminated soil.
4. Confirmation sampling of waste pit excavations to verify achievement of remediation levels.
5. Pretreatment (sorting/crushing/shredding) of waste.
6. Treatment of the waste by thermal drying as required to meet the waste acceptance criteria of the disposal facility.
7. Waste sampling and analysis prior to shipment to ensure that the waste acceptance criteria of the disposal facility are met.
8. Off-site shipment of waste for disposal at a permitted commercial waste disposal facility. It was estimated that over 600,000 cubic yards of waste material will be excavated and disposed as low-level radioactive waste.
9. As a contingency, shipment of any waste that fails (due to radiological concentrations) to meet the waste acceptance criteria of the permitted commercial waste disposal facility (up to 10 percent of the total waste volume) for disposal at the Nevada Test Site.
10. Decommissioning and removal of the drying treatment unit and associated facilities, as well as miscellaneous structures and facilities within the operable unit. Oversized material that is amenable to the selected alternative for Operable Unit 3 would be segregated from Operable Unit 1 waste, decontaminated, and forwarded to Operable Unit 3 to be managed as construction rubble.
11. Disposition of remaining Operable Unit 1 residual contaminated soils, as amenable, consistent with selected remedies for contaminated process area soils as documented in the Operable Unit 5 ROD. Any materials not consistent with the Operable Unit 5 remedy will be disposed as waste pit materials (i.e., shipped off-site).
12. Placement of backfill into excavations and construction of cover system.

1 This remedy addresses the principal threats posed by Operable Unit 1 by removing waste  
2 materials and contaminated soils to health-based levels, and treating waste materials and  
3 soils to facilitate waste handling. These actions reduce the potential for contaminant  
4 migration and will ensure disposal facility waste acceptance criteria are met. The waste  
5 will then be disposed at a permitted off-site disposal facility in accordance with applicable  
6 requirements. By implementing this remedy, the waste material will not be available for  
7 direct human or ecological contact or for migration into the underlying Great Miami  
8 Aquifer.

9 Initiation of the selected remedy began in April 1996. As of September 2003,  
10 approximately 75% of waste and waste-like materials have been excavated, processed,  
11 and shipped offsite for permanent disposal.

#### 12 **EXPLANATION OF REMEDY CHANGES**

13 The remedy changes addressed in this ROD Amendment include:

- 14 1. Aligning the surface and subsurface soil final remediation levels (FRLs) found in the  
15 Operable Unit 1 ROD with the approved FRLs for soil in the Operable Unit 5 ROD.
- 16 2. Placement of Pit 4 soil cover materials meeting on-site waste acceptance criteria into  
17 Fernald's On-site Disposal Facility for permanent disposal.
- 18 3. Aligning the final cover design for the waste pit area as originally designated in the  
19 Operable Unit 1 Feasibility Study and ROD, with the current design from the July 1998  
20 "Draft Final Natural Resource Impact Assessment and Natural Resource Restoration  
21 Plan" for the site.
- 22 4. Along with these changes, the ROD Amendment also provides clarification to  
23 terminology.

#### 24 **Adjustment of Soil Remediation Levels**

25 In the early 1990s soil cleanup levels were established individually for source control  
26 operable units (Operable Units 1, 2, and 4) along with the site-wide environmental media  
27 unit (Operable Unit 5). The decision documents for each of the source control operable  
28 units acknowledged that final soil cleanup levels established through Operable Unit 5  
29 would be reexamined for applicability to the source control units once the Operable Unit 5  
30 process was complete.

31 During the Operable Unit 1 and 5 ROD development process, it was also acknowledged  
32 that a formal public review process (i.e., a ROD Amendment) would be utilized if future  
33 realignments resulted in the raising of any Operable Unit 1 soil cleanup levels to match

1 higher Operable Unit 5 values. As directed through the earlier ROD agreements, all lower  
2 Operable Unit 5 levels must be utilized to guide soil cleanup in the Operable Unit 1 area,  
3 and no decision-document changes are necessary to automatically move to these lower  
4 levels for the constituents affected.

5 Therefore, the realignment to the higher Operable Unit 5 technetium-99 level is being  
6 accomplished through this ROD Amendment.

#### 7 **Disposition of Pit 4 Cap Materials**

8 This change allows for the disposal of approximately 8,155 cubic yards (out of an  
9 estimated total of 14,600 cubic yards) of soil materials used to construct the surface  
10 layers of the Pit 4 cap. These soils have been shown to:

- 11 • Meet the waste acceptance criteria for the On-site Disposal Facility, as demonstrated  
12 through a comprehensive sampling and analysis program performed under the  
13 February 24, 2002 Project Specific Plan for the Waste Pits Remedial Action Project  
14 Investigation of Waste Pit 4 Cap Material. The results were then documented in the  
15 August 15, 2002 Waste Pit 4 Cap Excavation Implementation Plan.
- 16 • No longer be needed as blending stock to meet Department of Transportation (DOT)  
17 shipping and/or Envirocare waste acceptance requirements, or as construction  
18 materials for roads and embankments within the Waste Pit project area.

19 While this change has no impact on the overall protectiveness of the Operable Unit 1 remedy,  
20 it does represent a significant cost savings to the government. Savings in processing,  
21 shipping, and disposal costs of approximately \$4.52 million will be realized through this  
22 change.

## 1     **Updating of Final Cover**

2     The final element of the Operable Unit 1 remedy described in the 1995 ROD, was  
3     "placement of backfill into excavations and construction of cover system." Based on all  
4     ROD decisions considered collectively, as long as the Operable Unit 1 soil cleanup  
5     activities are completed to the point where the health-protective Operable Unit 5 cleanup  
6     levels are achieved, then a specially designed cover system will no longer be technically  
7     necessary. Once the waste pit and subsurface soil excavations are complete, and  
8     remediation certification has been accomplished to satisfy the Operable Unit 5 soil cleanup  
9     levels, the Operable Unit 1 project area will be re-graded and restored consistent with the  
10    July 1998 Draft Final Natural Resource Impact Assessment and Natural Resource  
11    Restoration Plan. As conveyed in this plan, re-seeding and re-vegetation of the final  
12    graded area will take place consistent with the Soil Conservation Service and Ohio  
13    Department of Natural Resources "Rainwater and Land Development" guidance.

## 14    **Clarification of Terminology**

15    This ROD Amendment also provides additional detail for certain terminology used in waste-  
16    pits project planning and implementation documents. The intent of these clarifications is  
17    to provide clearer definitions of the individual remediation elements comprising the  
18    Operable Unit 1 scope. These clarifications will assist in defining the endpoints of the  
19    project, and the work scope handoffs between the Waste Pits Project (i.e., Operable  
20    Unit 1) and the Soil and Disposal Facility Project (i.e., Operable Unit 5) that will perform  
21    the final step of soil remediation beneath the pits.

22

1 **STATUTORY DETERMINATIONS**

2 The selected remedy is protective of human health and the environment, complies with  
3 Federal and State requirements that are legally applicable or relevant and appropriate to  
4 the remedial action, and is cost effective. This remedy utilizes permanent solutions and  
5 alternative treatment (or resource recovery) technologies to the maximum extent  
6 practicable, and satisfies the statutory preference for remedies that employ treatment that  
7 reduces contaminant toxicity, mobility, or volume as a principal element.

8 In accordance with CERCLA 121(c) and Section XXX of the Amended Consent Agreement  
9 between the U.S. Environmental Protection Agency (EPA) and the Department of Energy,  
10 EPA will review this remedial action, from a site-wide perspective, no less often than each  
11 five years after the implementation of final remedial actions to assure that human health  
12 and the environment are being protected by the remedial actions.

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21 Robert Warther, Manager  
22 United States Department of Energy – Ohio Field Office  
23  
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\_\_\_\_\_  
Date

26  
27 \_\_\_\_\_  
28 William E. Muno, Director  
29 Superfund Division  
30 United States Environmental Protection Agency – Region V  
31

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Date



## 1.0 INTRODUCTION

Site Name: **Fernald Environmental Management Project, Operable Unit 1**  
Site Location: Hamilton and Butler Counties  
Lead Agency: U.S. Environmental Protection Agency, Region V (USEPA)  
Support Agency: Ohio Environmental Protection Agency (Ohio EPA)

### 1.1 BACKGROUND

A Record of Decision (ROD) for the Fernald Environmental Management Project (now known as the Fernald Closure Project), Operable Unit 1 was signed on January 24, 1995 by the U.S. Department of Energy (DOE) and on March 1, 1995 by the USEPA. This Amendment to the ROD (ROD Amendment) has been prepared to document the nature of the change made to the selected remedy identified in the 1995 Final Operable Unit 1 ROD. This Amendment is issued in accordance with Section 117(c) of the Comprehensive Environmental Response, Compensation and Liability Act, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) (hereinafter jointly referred to as CERCLA), 42 USC §9617(c), and 40 CFR§300.435(c)(2)(ii).

This ROD Amendment does not make "fundamental changes" (within the meaning of the Environmental Protection Agency's Office of Solid Waste and Emergency Response Directive 9355.3-02FS-4, 'Guide to Addressing Pre-ROD and Post ROD Changes', April 1992) to the key components of the remedial action. The ROD Amendment documents disposition of contaminated cap materials; provides for adjustment of soil remediation levels as allowed for in the original ROD; and provides clarification on terminology. The ROD Amendment will be incorporated into the Fernald Environmental Management Project Administrative Record which is available at the Public Environmental Information Center (PEIC), located in Trailer 210 at the Fernald Closure Project, 7400 Willey Road, Hamilton, Ohio, 45013-9402, (513) 648-7480.

## 2.0 SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY

The 1,050-acre Fernald Closure Project site is located in southwestern Ohio, about 18 miles northwest of the city of Cincinnati, Ohio, and is situated on the boundary between Hamilton and Butler counties. Former uranium processing operations at the Fernald Closure Project were limited to a fenced, 136-acre tract, closed to public access, known as the former Production Area. The remaining Fernald Closure Project site areas consist of forest and pasture lands, a portion of which is leased for grazing livestock.

Operable Unit 1 is a well-defined, 37.7-acre area located in the northwest quadrant of the Fernald Closure Project site. Large quantities of liquid and solid wastes were generated by various chemical and metallurgical processing operations and these wastes were stored or disposed in six waste pits and the Clearwell, or burned in the Burn Pit. These pits are located in a portion of the Fernald Closure Project Waste Storage Area and are contained within the boundaries of Operable Unit 1.

The USEPA is the lead agency and the Ohio EPA is the supporting agency with regard to the remedial action at the Fernald Closure Project. On March 1, 1995, USEPA signed a ROD for Operable Unit 1 that had been approved by the Ohio EPA. The remedy presented in the 1995 ROD is removal, treatment, and off-site disposal at a permitted commercial disposal facility. The remedy consists of the following key components:

1. Construction of waste processing and loading facilities and equipment.
2. Removal of water from open waste pits for treatment at the site's wastewater treatment facility.
3. Removal of waste pit contents, caps and liners, and excavation of surrounding contaminated soil.
4. Confirmation sampling of waste pit excavations to verify achievement of remediation levels.
5. Pretreatment (sorting/crushing/shredding) of waste.
6. Treatment of the waste by thermal drying as required to meet the waste acceptance criteria of the disposal facility.
7. Waste sampling and analysis prior to shipment to ensure that the waste acceptance criteria of the disposal facility are met.
8. Off-site shipment of waste for disposal at a permitted commercial waste disposal facility. It is estimated that over 600,000 cubic yards of waste material will be excavated and disposed as low-level radioactive waste.

- 1 9. As a contingency, shipment of any waste that fails (due to radiological  
2 concentrations) to meet the waste acceptance criteria of the permitted commercial  
3 waste disposal facility (up to 10 percent of the total waste volume) for disposal at the  
4 Nevada Test Site.
- 5 10. Decommissioning and removal of the drying treatment unit and associated facilities,  
6 as well as miscellaneous structures and facilities within the operable unit. Oversized  
7 material that is amenable to the selected alternative for Operable Unit 3 would be  
8 segregated from Operable Unit 1 waste, decontaminated, and forwarded to Operable  
9 Unit 3 to be managed as construction rubble.
- 10 11. Disposition of remaining Operable Unit 1 residual contaminated soils, as amenable,  
11 consistent with selected remedies for contaminated process area soils as documented  
12 in the Operable Unit 5 Record of Decision. Any materials not consistent with the  
13 Operable Unit 5 remedy will be disposed as waste pit materials (i.e., shipped off-site).
- 14 12. Placement of backfill into excavations and construction of cover system.

15 This remedy addresses the principal threats posed by Operable Unit 1 by removing waste  
16 materials and contaminated soils to health-based levels, and treating waste materials and  
17 soils to facilitate waste handling. These actions reduce the potential for contaminant  
18 migration and will ensure disposal facility waste acceptance criteria are met. The waste is  
19 being disposed at a permitted off-site disposal facility (Envirocare) in accordance with  
20 applicable requirements. By implementing this remedy, the waste material will not be  
21 available for direct human or ecological contact or for migration into the underlying Great  
22 Miami Aquifer.

23

### 3.0 BASIS FOR AMENDING THE 1995 ROD

Site preparation activities for implementing the Operable Unit 1 ROD were initiated on April 1, 1996. These activities satisfied the criteria for commencement of substantial continuous physical on-site remediation no later than 15 months after the signing of the ROD. On September 20, 1996, the contract for disposal of Operable Unit 1 wastes was awarded to Envirocare of Utah. On October 20, 1997, IT Corporation (now Shaw E&I) was awarded the contract for the design, construction, operation, and D&D of processing facilities necessary to treat the pit waste and load into railcars for transportation to, and disposal at, Envirocare.

Initiation of operations began on February 22, 1999, with the processing of waste soils destined for off-site disposal by Operable Unit 1. Actual excavation and processing of pit waste began in September 1999. Through September 2003, a majority of Pits 1 and 3, as well as approximately half of Pit 2 and 60% of Pits 4 and 5 have been excavated, totaling approximately 615,000 tons of material that has been loaded into railcars and shipped to Envirocare for disposal. With a total of approximately 810,000 tons to be shipped to Envirocare for disposal, remediation is approximately 75% complete.

The remedy changes addressed in this ROD Amendment include:

1. Aligning the surface and subsurface soil FRLs from the Operable Unit 1 ROD with the approved soil FRLs found in the Operable Unit 5 ROD.
2. Placement of Pit 4 soil cover material meeting on-site waste acceptance criteria into the On-Site Disposal Facility for permanent disposal.
3. Aligning the final cover design for Operable Unit 1 with the current design from the July 1998 "Draft Final Natural Resource Impact Assessment and Natural Resource Restoration Plan".

## 4.0 DESCRIPTION OF REMEDY CHANGES

### 4.1 Adjustment of Soil Remediation Levels

Back in the early 1990s soil cleanup levels were established individually for the source control operable units (Operable Units 1, 2, and 4) along with the site-wide environmental media unit (Operable Unit 5). While this created redundancy, it helped assure that each of the source control units was allowed to address all aspects of cleanup within the operable unit boundary, independent of the site-wide cleanup activities under Operable Unit 5. This step allowed the various operable units to individually develop cleanup plans even though the various RODs trailed one another by a year or more.

As part of this approach, the decision documents for each of the source control operable units acknowledged that final soil cleanup levels established through Operable Unit 5 would be reexamined for applicability to the source control units once the Operable Unit 5 process was complete. For Operable Unit 1, the following statement was placed in the 1995 ROD to accommodate this approach: "The Operable Unit 1 remediation levels in this Record of Decision will be reexamined by the Operable Unit 5 Feasibility Study and ROD, based upon available Operable Unit 5 Feasibility Study conclusions, recommendations from the Fernald Citizen's Advisory Task Force, and public comment".

Later, the Operable Unit 5 ROD brought closure to this process by including the following requirement: "Where the final soil remediation level for a specific constituent established through the Operable Unit 5 decision process is more restrictive (i.e., lower) than that defined in an individual ROD for Operable Units 1, 2, or 4, the final Operable Unit 5 remediation level will serve as the soil cleanup criteria within the boundary of the source operable unit."

**Soil Cleanup Level Comparisons** – In 2003, major portions of the Waste Pits Project are nearing completion of waste excavation and processing activities. As such, it is appropriate that the project address the realignment of the soil cleanup levels since the focus will soon turn to final soil remediation within the project boundary. Once pit wastes and contaminated liners are removed, surface and subsurface soils will be remediated to the extent necessary to provide long-term protection of the underlying Great Miami Aquifer and to achieve the intended "undeveloped park" future land use adopted by Operable Unit 5.

Consistent with this remediation objective, a review was performed to compare the Operable Unit 1 surface and subsurface soil cleanup levels with the corresponding soil cleanup levels from Operable Unit 5. The review showed that the Operable Unit 5 soil cleanup levels are lower than those adopted for Operable Unit 1 for all constituents and all cases, with the exception of one constituent: technetium-99 in subsurface soil. As shown in Table 1, the final level selected for technetium-99 as a site-wide level in Operable Unit 5 (30 pCi/g) is higher than the pit-specific subsurface levels calculated for Operable Unit 1 (0.26 to 9.9 pCi/g).

During the Operable Unit 1 and 5 ROD development process, it was acknowledged that a formal public review process (i.e., a ROD Amendment) would be utilized if future realignments resulted in the raising of any Operable Unit 1 soil cleanup levels to match higher Operable Unit 5 values. As directed through the earlier ROD agreements, all lower Operable Unit 5 levels must be utilized to guide soil cleanup in the Operable Unit 1 area, and no decision-document changes are necessary to automatically move to these lower levels for the constituents affected.

Table 1 Technetium-99 Soil Cleanup Level Comparison	
Pit 1	Not Present as a Constituent of Concern
Pit 2	5.5
Pit 3	0.75
Pit 4	0.26
Pit 5	1.4
Pit 6	7.3
Burn Pit	14
Clearwell	9.9
On-Property Final Remediation Level for the Undeveloped Park Land Use	
30	

The realignment to the higher Operable Unit 5 technetium-99 level is being accomplished through this ROD Amendment.

1 The original 1995 Operable Unit 1 technetium-99 subsurface soil cleanup levels were  
2 developed via a screening-level environmental model. In the screening approach, it was  
3 conservatively assumed that groundwater contaminant concentrations – derived from the  
4 leaching of residual soil contamination – would need to achieve the lower-bound  $10^{-6}$   
5 incremental lifetime cancer risk (ILCR) target within the acceptable  $10^{-4}$  to  $10^{-6}$  range  
6 adopted by the Superfund program. The lower-bound  $10^{-6}$  groundwater risk target was  
7 conservatively utilized to guide the setting of Operable Unit 1 soil cleanup levels because  
8 the Operable Unit 5 process had not yet established approved site-wide groundwater  
9 cleanup risk targets and corresponding cleanup levels. At that point in time, Operable  
10 Unit 5 trailed Operable Unit 1 by about 18 months in the decision-making schedule.

11 Similarly, individual pit-specific technetium-99 cleanup levels were then set from the  
12 screening model under the conservative assumption that the entire thickness of pit wastes  
13 (which vary from pit to pit) would be available to leach into the aquifer over the long term.  
14 In other words, it was assumed for modeling purposes that the pit wastes would  
15 hypothetically remain in place as a continuing source term at their present day pit  
16 thickness.

17 These conservative assumptions and decisions were carried forward for inclusion in the  
18 Operable Unit 1 ROD, pending the outcome of the Operable Unit 5 site-wide decision-  
19 making process.

20 As part of the Operable Unit 5 decision-making, site-wide groundwater risk targets were  
21 subsequently set based on Federal Safe Drinking Water Act Maximum Contaminant Levels  
22 (MCLs), or a  $10^{-5}$  risk target in the absence of MCLs. This is in contrast to the more  
23 conservative  $10^{-6}$  value adopted in Operable Unit 1. The  $10^{-5}$  risk target is within the U.S.  
24 EPA's target risk range of  $10^{-4}$  to  $10^{-6}$  and therefore is an acceptable risk level. Using the  
25 MCL/ $10^{-5}$  groundwater target, the Operable Unit 5 cross-media soil cleanup levels were  
26 developed using a comprehensive model that included a detailed, realistic consideration of  
27 the residual quantity of material available to leach to the aquifer at any given location over  
28 the long term. For the Waste Pits Project, the Operable Unit 5 model realistically assumes  
29 that the pit contents are removed and are therefore not a continuing leachable source that  
30 needs to be represented in the model.

1 All of the Operable Unit 5 cross-media modeling parameters and inputs were developed in  
2 concert with USEPA under a decision-making process that occurred approximately  
3 18 months after the signing of the Operable Unit 1 ROD.

4 Based on the detailed modeling analyses conducted to evaluate technetium-99 mobility  
5 and residual leaching potential, the Operable Unit 5 soil cleanup level was found to be  
6 protective of the Great Miami Aquifer at the approved MCL/ $10^{-5}$  risk target for all residual  
7 contaminant conditions evaluated. Therefore, in consideration of this finding, it is  
8 appropriate that it be adopted to guide final soil cleanup in the Operable Unit 1 footprint  
9 once the pit wastes are fully removed such that they can no longer serve as a continuing  
10 source term.

11 Table 2 summarizes the principal differences in assumptions or approach between the  
12 earlier screening-level environmental modeling conducted for Operable Unit 1 and the more  
13 comprehensive fate and transport modeling conducted for assessing cross-media impacts  
14 under Operable Unit 5.



**Table 2**  
**Comparison of Modeling Approach and Assumptions Used to Develop**  
**the Operable Unit 1 and 5 Technetium-99 Soil Cross-Media Cleanup Levels**

Approach/Assumption	Operable Unit 1	Operable Unit 5
Modeling Approach	"Screening level" spreadsheet model	Comprehensive Fate and Transport model used to develop the health-protective Operable Unit 5 cross-media soil cleanup levels
Range of Applicability	The screening-level modeling needed to address the full range of Operable Unit 1 remedial alternatives that were under consideration in the Feasibility Study prior to the ROD. The alternatives under consideration included capping the pit wastes in place, as well as full removal of the wastes for off-site disposal.	Able to incorporate the actual ROD-based remedy decisions reached for Operable Units 1, 2, 3 and 4. For Operable Unit 1, the final decision – full waste pit removal and off-site disposal – was incorporated into the model to set the subsequent health protective cross-media soil cleanup levels.
Target Great Miami Aquifer Risk Level Used In Decision-making	$10^{-6}$ Incremental Lifetime Cancer Risk (ILCR) level. The $10^{-6}$ risk level was used pending the final risk target selected for Operable Unit 5.	The final selected risk targets for Operable Unit 5 were the Federal Safe Drinking Water Act MCLs for each constituent of concern, or $10^{-5}$ ILCR in the absence of MCLs. (For technetium-99, the $10^{-5}$ ILCR target was used.)
How Waste-Pit Material Source Term Was Accounted For in the Model	Represented as a continuing source based on full pit waste thicknesses in place (needed to encompass the capping alternatives during the Feasibility Study). This resulted in the need to establish pit-specific cleanup levels, since each pit has a different geometry and waste thickness. Pit 1 did not have technetium-99 present as a constituent of concern, so a pit-specific value was not required.	The modeling specifically acknowledged that the full thickness of waste-pit materials would be removed per the final Operable Unit 1 ROD. The only remaining source would be the underlying residual soils, which were accounted for as a finite source in the Operable Unit 5 cross-media impact model.
Fate and Transport Parameters used in the Model	Literature values in the absence of site-specific data under development by Operable Unit 5.	Site-specific geochemical data developed directly through the Operable Unit 5 Remedial Investigation.

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#### 4.2 On-Site Disposal of Pit 4 Cap Materials

This second proposed change permits the on-site disposal of a portion of the Pit 4 soil cap material in the On-site Disposal Facility, rather than shipping the soil off site for disposal as stated in the 1995 Operable Unit 1 ROD.

Specifically, this change would allow the disposal of approximately 8,155 cubic yards (out of an estimated total of 14,600 cubic yards in the Pit 4 cap) of soil materials used to construct the surface layers of the cap. These soils have been shown to:

- Meet the waste acceptance criteria for the On-site Disposal Facility, as demonstrated through a comprehensive sampling and analysis program performed under the February 24, 2002 Project Specific Plan for the Waste Pits Remedial Action Project Investigation of Waste Pit 4 Cap Material. The results were then documented in the August 15, 2002 Waste Pit 4 Cap Excavation Implementation Plan.
- No longer be needed as blending stock to meet DOT shipping and/or Envirocare waste acceptance requirements, or as construction materials for roads and embankments within the Waste Pit project area.

While this change has no impact on the overall protectiveness of the Operable Unit 1 remedy, it does represent a significant cost savings to the government. Savings in processing, shipping, and disposal costs of approximately \$4.52 million will be realized through this change.

The Pit 4 cap was constructed in 1988 and 1989 from soil materials obtained from various locations on-site. The cap was constructed in three layers, with each layer constructed of materials obtained from different on-site locations. The upper two layers of the cap, representing the top 3 to 3.5 feet of material, were identified for potential placement in the On-site Disposal Facility based on the following:

- These materials originated from areas of the site having little impact from plant operations, and therefore a high potential for meeting the On-site Disposal Facility waste acceptance criteria. Specifically, the soil materials used to construct the surface layers originated from the excavation of the east stormwater retention basin and from an undisturbed area located north of Pit 5.
- Historical analytical data from earlier sampling events in the Pit 4 cap confirmed low contaminant concentration levels within the surface layers (i.e., below the acceptance criteria limits for the On-site Disposal Facility).
- Sufficient blend and construction materials from other Waste Pit Project sources were determined to be available to meet future project needs.

1 To confirm that the targeted cap materials meet the On-site Disposal Facility waste  
2 acceptance criteria, a comprehensive sampling and excavation plan was developed and  
3 executed consistent with the requirements defined in the site's approved Site-wide  
4 Excavation Plan and On-site Disposal Facility Waste Acceptance Criteria Attainment Plan.  
5 The sampling process employed a combination of soil borings and real-time scanning  
6 technology to develop a three dimensional profile of contaminant concentrations within the  
7 Pit 4 cap. The results of this sampling process were documented in the August 15, 2002  
8 Waste Pit 4 Cap Excavation Implementation Plan. This Plan also documented an  
9 excavation approach that targeted only those materials that meet the On-site Disposal  
10 Facility waste acceptance criteria. This included maintaining a safety margin during the  
11 excavation process between the above- and below-waste- acceptance-criteria materials to  
12 ensure that only waste-acceptance-criteria compliant materials would be removed for  
13 disposal in the On-site Disposal Facility.

14 As stated previously, the resultant volume of waste-acceptance-criteria compliant material  
15 removed from the Pit 4 cap was approximately 8,155 cubic yards. This material is  
16 currently stockpiled and segregated awaiting a final determination on this proposed  
17 change. The remaining volume of cap material left for off-site disposal and potential  
18 blending stock (if needed) is approximately 6,445 cubic yards.

19 Since initiation of operations, various planning or implementation constraints originally on  
20 the project have been modified, thereby making this proposed change possible. Three  
21 modifications in particular provide necessary relief with respect to blending requirements:

- 22 • DOE was granted an exemption by the Department of Transportation to ship material  
23 with a higher radiological content in closed top gondola cars; for the Waste Pits  
24 Project, this means the project requires less blend material to achieve shipping based  
25 radiological constraints.
- 26 • Due to additional engineering improvements at their rail car rollover facility, Envirocare  
27 was able to raise the radiological limits for thorium-230 associated with emptying  
28 railcars at the facility from 5,000 pCi/g to 10,000 pCi/g for Fernald's waste-pit  
29 materials. Again this increased flexibility results in the need for less blending stock to  
30 achieve the Envirocare disposal criteria.
- 31 • Envirocare has provided additional flexibility on the range of acceptable moisture  
32 contents for the waste-pit material received at the facility. This particular change  
33 reduces the need for soil based blending stock for the higher moisture content pit  
34 wastes.

1 In addition to these modifications, the Waste Pits Project has received sufficient quantities  
2 of soil destined for off-site disposal from other site projects that can – along with the  
3 remaining Pit 4 cap soils – meet the needs for construction of various working ramps and  
4 corridors within the waste pit excavation area.

5 And lastly, the projections for future soil volumes that are destined for off-site disposal  
6 through the Waste Pits Project further demonstrate that sufficient soil will be available to  
7 meet the remaining blending needs for the final segments of the project. As a result of  
8 these cumulative modifications and operational flexibilities, the amount of blending  
9 material originally believed necessary to satisfy implementation constraints has decreased  
10 to a readily manageable quantity.

11 The amendment to the Operable Unit 1 ROD to permit placement of the Pit 4 soil cover  
12 material into the On-site Disposal Facility will complete the documentation process.

#### 13 **4.3 Updating of Final Cover**

14 The final element of the Operable Unit 1 remedy described in the 1995 ROD, "placement  
15 of backfill into excavations and construction of cover system", requires a technical  
16 modification to make the originally designated cover system from the 1994 Feasibility  
17 Study and the 1995 ROD consistent with the final natural resource restoration plan and  
18 design approach that is being adopted site wide as part of Operable Unit 5. Change No.3  
19 is therefore included in this ROD Amendment to formally adopt this modification.

20 In reviewing the document history and decision trail for Operable Unit 1 (the Feasibility  
21 Study, ROD, and Remedial Design Work Plan) to track the origin and intent of the Operable  
22 Unit 1 cover system, it became clear that the cover system – which is a multi-layer  
23 6.5-foot thick infiltration barrier similar in composition and function to the On-site Disposal  
24 Facility cap – was first put into the Operable Unit 1 remedy at the time of the Feasibility  
25 Study (and carried forward to the ROD) because final land-use based decision making  
26 under Operable Unit 5 was not yet complete and final health protective soil cleanup levels  
27 (that would not need a multi-layer infiltration barrier) had not yet been formally approved.

1 Based on all of the ROD decisions considered collectively, as long as the Operable Unit 1  
2 soil cleanup activities are completed to the point where the health-protective Operable  
3 Unit 5 cleanup levels are achieved, then the 6.5-foot thick multi-layer infiltration barrier  
4 will no longer be technically necessary. It is also clear from the decision trail that by the  
5 time the July 1995 Operable Unit 1 Remedial Design Work Plan was developed and  
6 approved, Operable Unit 5 decision making had been finalized to the point where the  
7 Operable Unit 1 Remedial Design Work Plan was able to acknowledge the site-wide  
8 decisions on restoration that were emerging from the Operable Unit 5 decision process,  
9 and that installation of the 6.5-foot thick infiltration barrier cover system would not be  
10 necessary.

11 This was recognized on Page 2-8 of the July 1995 Work Plan which states, "The  
12 backfilling and final covering of the waste pit area will be performed in a manner which is  
13 consistent with the future land-use strategy determined by the approved Operable Unit 5  
14 Record of Decision." This has remained as the technical planning and design case ever  
15 since.

16 As the final step of the site-wide integration process, the July 1998 Draft Final Natural  
17 Resource Impact Assessment and Natural Resource Restoration Plan formally adopted a  
18 consistent restoration design approach within the source-control operable units (1, 2  
19 and 4) once the health-protective Operable Unit 5 soil cleanup levels are achieved site  
20 wide across all areas.

21 In light of this decision trail, as with all other areas of the site, once the waste pit and  
22 subsurface soil excavations are complete, and remediation certification has been  
23 accomplished to satisfy the Operable Unit 5 soil cleanup levels, the Operable Unit 1 project  
24 area will be re-graded and restored consistent with the July 1998 Draft Final Natural  
25 Resource Impact Assessment and Natural Resource Restoration Plan. As conveyed in this  
26 plan, re-seeding and re-vegetation of the final graded area will take place consistent with  
27 the Soil Conservation Service and Ohio Department of Natural Resources "Rainwater and  
28 Land Development" guidance.

1 For administrative reasons, this ROD Amendment formally acknowledges that the 6.5-foot  
2 thick cover system is no longer necessary, since the cover system was included in the  
3 1995 Operable Unit 1 ROD as a recognized component. This administrative step will allow  
4 the Operable Unit 1 decision documents (the ROD and ROD Amendment) to stay current  
5 with the approved approaches for site-wide re-grading and restoration that were developed  
6 later through the design process.

7 **Clarification on Terminology** – This ROD Amendment also provides additional detail for  
8 certain terminology used in waste-pits project planning and implementation documents.  
9 The intent of these clarifications is to provide clearer definitions of the individual  
10 remediation elements comprising the Operable Unit 1 scope.

11 These clarifications will assist in defining the endpoints of the project, and the work scope  
12 handoffs between the Waste Pits Project (i.e., Operable Unit 1) and the Soil and Disposal  
13 Facility Project (i.e., Operable Unit 5) that will perform the final step of soil remediation  
14 beneath the pits.

15 Contaminated Liners: During the original pit construction, the liners for pits 1, 2, 3 and 4,  
16 the Burn Pit, and the Clearwell were constructed from on-site native clay. The liners were  
17 either “dug into” existing clay, or constructed from clay brought in from another area of  
18 the site. In contrast, the liners for pits 5 and 6 were constructed of a synthetic barrier  
19 over the in-place clay.

20 Chapter 10 of the 1995 Operable Unit 1 ROD contains the statutory determinations that  
21 must be met by the selected remedy in order for it to be declared protective of human  
22 health and the environment. Page 10-1 states that the selected remedy is considered  
23 protective by: “(1) removing the sources of contamination to health based levels;  
24 (2) treating (by thermal drying) the materials causing the principal threats from Operable  
25 Unit 1; (3) disposing of treated materials at an off-site location which provides the  
26 appropriate level of long-term protectiveness; and (4) remediating residual contaminated  
27 soils to levels which are protective”. Page 10-2 goes on to state that the remedy is  
28 protective because it requires that the “waste pit contents, contaminated liners, and  
29 grossly contaminated cover materials and residual soils as required, be excavated, treated  
30 by thermal drying and disposed of off site at a permitted commercial disposal facility”.

1 The ROD, however, then remained silent on the technical definition of "contaminated  
2 liners" and the accompanying threshold levels of liner contamination that would trigger the  
3 need for off-site disposal to maintain the health-protective status of the remedy. That  
4 technical threshold was subsequently established approximately 18 months later by the  
5 1996 Operable Unit 5 ROD, which set in motion the health-protective WAC limits for soil  
6 and soil-like materials contemplated for disposal on site, and the attendant contaminant  
7 concentration levels that would require such materials to be sent off site for disposal.

8 Recognizing that the Operable Unit 5 ROD has established the appropriate health-based  
9 levels for on-site disposal, this section of the ROD Amendment clarifies the process by  
10 which the contaminated liners will be addressed and subsurface soils underlying the pits  
11 will be characterized to support subsequent health-based disposal decisions. The  
12 characterization approach will follow the agency approved protocols defined in the Site-  
13 wide Excavation Plan (SEP), the OSDF WAC Attainment Plan, and the individual  
14 excavation control Project-Specific Plans (PSPs) developed to identify above-WAC  
15 materials in the individual soil remediation areas across the site. These protocols are  
16 designed to support the on- and off-site disposal decisions for contaminated soils within  
17 the Operable Unit 5 area and in the affected soils beneath the other four source operable  
18 units.

19 The protocols employ a comprehensive sampling strategy involving a combination of real-  
20 time radiological scanning and discrete physical sampling to determine the depth and areal  
21 extent of materials that are ineligible for on-site disposal based on contaminant  
22 concentration levels. In general, the characterization protocols for contaminated liners and  
23 subsurface materials will be applied as described below.

24 For those pits constructed with native clay liners (i.e., Pits 1, 2, 3, and 4), the first  
25 six inches of clay liner material below the waste/liner interface will be removed for disposal  
26 off site. This step provides an added level of assurance that any potential waste material  
27 that may have become commingled within the surface horizon of the native clay liners will  
28 be adequately removed for off-site disposal. In addition, visual reconnaissance walk-  
29 downs will be performed after removal of the six inches to further assure that visible  
30 waste materials have been adequately removed.

1 These two efforts provide a working "base level" condition to then begin application of the  
2 comprehensive real-time and physical sampling protocols. From the sampling, all materials  
3 that are found through analytical measurement to be contaminated above the OSDF WAC  
4 concentration thresholds will be sent off-site for disposal. Similarly, those materials found  
5 to meet the OSDF WAC concentration thresholds will be eligible for disposal on site.

6 Together, these three implementation steps (removal of the top six inch surface horizon for  
7 off-site disposal, follow-up visual reconnaissance and removal of any identified remaining  
8 commingled waste material, and the follow-on comprehensive sampling protocols) define  
9 the technical approach that will be used for identifying and dispositioning "contaminated  
10 liners" in a health-protective manner as envisioned by the statutory determinations  
11 summarized on pages 10-1 and 10-2 of the 1995 ROD.

12 Note that for those two pits that employed synthetic liners rather than native clay liners  
13 (Pits 5 & 6), the synthetic liner will also be shipped off-site for disposal, at which point the  
14 follow-on steps described above (removal of the top six inch surface horizon of native  
15 material for off-site disposal, follow-up visual reconnaissance and removal of any identified  
16 remaining commingled waste material, and the follow-on comprehensive sampling  
17 protocols) will be implemented to complete the process for these two pits.

18 The actual details of the process (sampling frequencies, depths, analytical parameters,  
19 detection levels, etc.) for application to the subsurface conditions beneath the pits will be  
20 defined in future Project Specific Plans that are subject to approval by the agencies.

21 Caps: For each of the waste pits, the type of material used for capping the pit varies.  
22 Similar to liners, cap material for each pit is defined as material that is readily  
23 distinguishable from waste material. Other than the decision in this ROD Amendment to  
24 permit a portion of the Pit 4 cap soil to be disposed of in the On-site Disposal Facility, the  
25 remaining cap materials will be (or have been) shipped off site for disposal along with the  
26 waste materials.



## 5.0 COMPARATIVE ANALYSIS

The modified remedy addresses threats to the public health, safety, welfare and the environment by contamination at and around the site. Comparative evaluations of the three proposed changes described in this plan with the 1995 and 1996 Operable Unit 1 and 5 RODs were conducted employing the nine evaluation criteria defined in the National Contingency Plan as the framework for identifying technical and administrative differences for consideration.

The first two evaluation criteria – overall protection of human health and the environment and compliance with ARARs – are considered threshold criteria that must be attained by the selected remedial action.

The next five criteria include short-term protectiveness, long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, implementability, and cost.

These criteria are considered primary balancing criteria, which are looked at collectively to arrive at the best overall solution that offers the best balance of tradeoffs among the criteria.

The final two criteria, state and community acceptance, are evaluated following receipt of comments, if any, during the formal public comment period. The State of Ohio has concurred with the modified remedy in this ROD Amendment. No comments were received from the public during the comment period.

Table 3 provides a summary of the comparative evaluations for the three proposed changes using the nine CERCLA National Contingency Plan criteria as the guiding framework.

**Table 3**  
**CERCLA Nine-Criteria Summaries for the ROD Amendment Changes**

<b>National Contingency Plan Criteria and Original Operable Unit 1 and 5 Decisions</b>	<b>Change No. 1 - Adjustment of Soil Remediation Levels</b>	<b>Change No. 2 - On-site Disposal of Pit 4 Cap Materials</b>	<b>Change No. 3 - Updating of Final Cover</b>
<b>1. Overall protection of human health and the environment.</b> The selected remedies in the Operable Unit 1 and 5 RODs are considered health protective as they will achieve EPA-approved risk based levels at remedy completion.	The Operable Unit 5 ROD soil cleanup levels were developed to be protective of human health consistent with the target land use as an undeveloped park. They are also protective of the Great Miami Aquifer at the target risk level. A decision to align the Operable Unit 1 levels with the Operable Unit 5 site-wide levels continues to achieve the threshold criteria of a remedy that is protective of human health and the environment.	The Waste Acceptance Criteria for the On-site Disposal Facility were developed to ensure protection of human health and the environment. Therefore, a decision to place Pit 4 cap material that has been demonstrated to meet the onsite waste acceptance criteria results in a remedy that continues to achieve the threshold criteria of a remedy that is protective of human health and the environment.	The Operable Unit 5 ROD soil cleanup levels were developed to be protective of human health consistent with the target land use as an undeveloped park. They are also protective of the Great Miami Aquifer at the target risk level. Therefore, achieving the health protective Operable Unit 5 soil cleanup levels within the Operable Unit 1 footprint eliminates the need for the installation of a 6.5 foot multi-layer infiltration barrier as originally envisioned.
<b>2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs).</b> Both the Operable Unit 1 and 5 remedies achieve compliance with all ARARs or have been granted the necessary EPA-approved waivers and/or exemptions.	The Operable Unit 1 and 5 RODs provide a list of the ARARs the selected remedy and associated soil cleanup levels must attain. A decision to adopt the Operable Unit 5 cleanup levels for soils within the Operable Unit 1 boundary is consistent with and does not alter the original ARARs for either ROD.	The Operable Unit 1 and 5 RODs provide a list of the ARARs the selected remedy and associated soil cleanup levels must attain. A decision to place the waste-acceptance-criteria-compliant Pit 4 cap soils into the On-site Disposal Facility is consistent with and does not alter the original ARARs for either ROD.	A decision to update the design of the Operable Unit 1 cover system to reflect the sitewide restoration approach presented in the Natural Resource Impact Assessment and Natural Resource Restoration Plan is consistent with and does not alter the original ARARs for Operable Unit 1.
<b>3. Long-Term Effectiveness and Permanence.</b> The Operable Unit 5 selected remedy reduces the residual risks associated with contaminated soil by leaving no contaminated material above health-based remediation levels, and therefore provides a remedy that is effective and permanent.	A decision to adopt the Operable Unit 5 cleanup levels for soils within the Operable Unit 1 boundary will continue to provide a remedy that achieves long-term effectiveness and permanence.	The On-site Disposal Facility relies on engineering measures and institutional controls (waste acceptance criteria) to ensure the long-term performance of the facility for waste acceptance criteria-compliant materials. A decision to place the compliant Pit 4 cap material into the On-site Disposal Facility does not compromise the effectiveness or permanence of the facility.	A decision to adopt the Operable Unit 5 cleanup levels for soils within the Operable Unit 1 boundary will continue to provide a remedy that achieves long-term effectiveness and permanence without the installation of a 6.5 foot multi-layer infiltration barrier.
<b>4. Reduction of Contaminant Toxicity, Mobility, or Volume Through Treatment.</b> Neither the Operable Unit 1 or 5 ROD remedies employ treatment as a principal element to further reduce contaminant toxicity, mobility, or volume. The statutory preference for treatment was considered adequately satisfied by the selected actions considering the waste forms, contaminant types, and disposal options.	As documented in the Operable Unit 1 and 5 RODs, treatment of contaminated soil was not adopted as a main component of the remedy. This change remains consistent with the earlier decision.	As documented in the Operable Unit 1 and 5 RODs, treatment of contaminated soil was not adopted as a main component of the remedy. This change remains consistent with the earlier decision.	As documented in the Operable Unit 1 and 5 RODs, treatment of contaminated soil was not adopted as a main component of the remedy. This change remains consistent with the earlier decision.
<b>5. Short-Term Effectiveness.</b> The selected remedies in the Operable Unit 1 and 5 RODs considered the short-term risks associated with remedy implementation during the original trade-off analyses. While the risks can never be fully eliminated, they can be effectively controlled through application of mitigative measures and reduction of haul distances and excavation volumes to the minimum health-protective levels.	Short-term risks associated with cleanup to the revised technetium-99 level will likely be the same or less than the original Operable Unit 1 remedy, because less soil volume may require excavation compared to original estimates. The preponderance of short-term risks are derived from construction-related injuries which are in turn directly linked to the amount of material handled.	Disposition of cap material in the On-site Disposal Facility could reduce the short-term risks by decreasing the potential for injuries associated with transporting the material off-site. Short-term risks in this instance are linked to not only the amount of material handled, but also the haul distance involved. In this case, for this material the haul distances have been shortened by nearly 1800 miles.	Updating the design of the Operable Unit 1 cover system to reflect the sitewide restoration approach presented in the Natural Resource Impact Assessment and Natural Resource Restoration Plan would likely reduce the short-term risks by decreasing the potential for construction related injuries associated with building a complex, multi-layer cover system.
<b>6. Implementability.</b> The selected remedies in the Operable Unit 1 and 5 RODs were considered implementable at the time of the original decisions. More than 5 years of history has been gained for each remedy that has proven their overall implementability and effectiveness.	This change does not alter the physical implementation methods of the original remedies. Therefore this factor is not materially affected by the change proposed in this plan.	The physical implementation of this proposed change eliminates the need for rail loadout and transportation. These elements are replaced by truck transport to the On-site disposal facility, which has been demonstrated to be implementable over 5 years of operations.	The restoration approach presented in the Natural Resource Impact Assessment and Natural Resource Restoration Plan for the Operable Unit 1 footprint is similar in scope to other areas of the site that have already been restored and therefore proven to be implementable.
<b>7. Cost.</b> The original Operable Unit 1 and 5 ROD remedies were found to have costs that were proportionate to the effectiveness achieved.	While the soil volume impacts associated with this change cannot be accurately defined (since the materials reside beneath the pits), it is projected that the savings will be significant and can help support other high-priority cleanup initiatives. Since the proposed change is targeted to still achieve health-based levels at completion, effectiveness is not reduced.	Cost savings from disposing of Pit 4 Cap material in On-site Disposal Facility as an alternative to off-site disposal at Envirocare is approximately \$4.5 million. Since the Pit 4 cap material has been demonstrated to meet the On-site disposal Facility Waste Acceptance Criteria, health-based requirements will continue to be achieved and therefore effectiveness will not be reduced.	Updating the Operable Unit 1 cover system design to reflect natural resource restoration rather than a complex multi-layer infiltration barrier will result in a significant savings in construction costs. These savings can help support other high-priority cleanup initiatives. Since the proposed change is targeted to still achieve health-based levels at completion, effectiveness is not reduced.
<b>8. State Acceptance.</b> The Ohio EPA had an opportunity to review and participate in the original Operable Unit 1 and 5 ROD decisions and concurred with the original remedies that were selected.	The Ohio EPA has had an opportunity to review and participate in the proposed change, and has indicated that they concur with the recommendation.	The Ohio EPA has had an opportunity to review and participate in the proposed change, and has indicated that they concur with the recommendation.	The Ohio EPA has had an opportunity to review and participate in the proposed change, and has indicated that they concur with the recommendation.
<b>9. Community Acceptance.</b> As prescribed under CERCLA, the original Operable Unit 1 and 5 RODs provided formal opportunities for gaining community acceptance. Community concerns were addressed in the formal Responsiveness Summaries attached to the RODs.	No comments were received during the public comment period.	No comments were received during the public comment period	No comments were received during the public comment period

**ARARs Identified for the Modified Remedy** – The selected remedy and the fundamental changes described in this ROD Amendment meet all applicable or relevant and appropriate requirements (ARARs), as identified in the Operable Unit 1 and OU5 RODs, of Federal and State statutes pursuant to CERCLA Section 121 (d)(1), except where waivers of Federal or State law are necessary. The fundamental changes identified in this ROD Amendment will not require waivers of Federal or state statutes.

Implementation of the changes will meet the ARARs as described in the original Operable Unit 1 and Operable Unit 5 RODs and is not affected by new ARARs.

**Summary of Support Agency Comments on the ROD Amendment** – The State of Ohio has concurred with the modified remedy in this ROD Amendment.

**Statutory Determinations** – In accordance with Section 121 of CERCLA, 42 U.S.C. § 9621, the modified remedy satisfies statutory requirements, listed as follows:

- Protection of human health and the environment
- Compliance with ARARs
- Cost effectiveness
- Utilizes permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable; and
- Satisfies the preference for treatment as a principal element or provide an explanation as to why this preference is not satisfied.

The first five-year review report for the site was issued in March 2001. For sites with multiple operable units, the five-year review is triggered by the onset of construction for the first operable unit remedial action that will result in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure. Site Preparation for the Waste Pit Remedial Action Project, which began on April 1, 1996, was the initial triggering action. This ROD Amendment will not change the site goal for a five-year review every five years.

1 **Public Participation Compliance** – In compliance with Section 117 of CERCLA, and the  
2 NCP Section 300.435(c)(2)(ii), the Proposed Amended Plan highlighting the modified  
3 remedy was published, notice was issued, and a public meeting held on  
4 September 30, 2003, to explain the ROD Amendment and receive comments. The public  
5 comment period commenced on September 17, 2003, and closed on October 17, 2003.  
6 Although members of the public attended the public meeting and were involved in  
7 discussions of the changes identified in this ROD Amendment, no comments were  
8 received from the public.

9

**ATTACHMENT A.1**

**TRANSCRIPT OF SEPTEMBER 30, 2003 PUBLIC HEARING**

1  
2  
3  
4  
5 PROPOSED PLAN FOR AN AMENDMENT  
6 TO THE OUI RECORD OF DECISION  
7 SEPTEMBER 30, 2003  
8

9 TRANSCRIPT OF PROCEEDINGS  
10

11 The above-styled cause came on for hearing  
12 at 6:30 p.m. on Tuesday, September 30, 2003 at  
13 Fluor Fernald, Inc., Trailer 214, Fernald  
14 Conference Room, 7400 Willey Road, Cincinnati,  
15 Ohio.  
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Spangler Reporting Services, Inc.

PHONE (513) 381-3330 FAX (513) 381-3342

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1 MR. STEGNER: Let's go ahead and  
2 open the formal public hearing portion. I'll  
3 remind you that you have until the 17th of October  
4 to get your comments on the record. If no one  
5 wants to speak tonight, one, twice, okay, thank you  
6 all for coming.

7 - - -  
8 PROCEEDINGS CONCLUDED  
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## C E R T I F I C A T E

I, BRITNEY L. FISHER, the undersigned, a  
notary public-court reporter, do hereby certify  
that at the time and place stated herein, I  
recorded in stenotypy and thereafter had  
transcribed with computer-aided transcription the  
within (2), two pages, and that the foregoing  
transcript of proceedings is a complete and  
accurate report of my said stenotypy notes.

MY COMMISSION EXPIRES:

JULY 3, 2005.

*Britney L. Fisher*  
BRITNEY L. FISHER  
NOTARY PUBLIC-STATE OF  
KENTUCKY

Spangler Reporting Services, Inc.

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STATE OF ARKANSAS  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
8001 NATIONAL DRIVE, P.O. BOX 8913  
LITTLE ROCK, ARKANSAS 72219-8913

**RECORD OF DECISION**  
**AMENDMENT NO. 1**

**MONROE AUTO PIT**  
**(Finch Road Landfill)**

**NOVEMBER 2000**

**DECLARATION  
FOR THE MONROE AUTO PIT SUPERFUND SITE  
(FINCH ROAD LANDFILL)  
PARAGOULD, ARKANSAS  
RECORD OF DECISION  
AMENDMENT NO. 1**

**SITE NAME AND LOCATION**

Monroe Auto Superfund Site, Paragould, Greene County, Arkansas

**STATEMENT OF BASIS AND PURPOSE**

This decision document presents an amendment to the previously selected remedial action for the Monroe Auto Superfund Site (Site). The new remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) (42 U.S. Code, Section 9601, et seq.), and, to the extent practicable, the National Contingency Plan (NCP) (40 CFR Part 300). This decision is based on the Administrative Record for this Site.

The U. S. Environmental Agency (EPA) Region 6 concurs with the selected remedy.

**ASSESSMENT OF THE SITE**

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this amendment, may present an imminent and substantial endangerment to the public health or welfare of the environment.

**DESCRIPTION OF THE REMEDY**

This Amendment changes the method of contaminated soil/sludge remediation described in the Record of Decision (ROD) executed by the Director of the Arkansas Department of Environmental Quality and the EPA Regional Administrator on September 26, 1996.

The method of remediation of soil/sludge is changed from containment to excavation and treatment required by the Resource Conservation and Recovery Act (RCRA), removal from the Site, and disposal in a permitted, secure waste disposal facility. The new remedy does not change the previously selected ground water remedy. This amended remedy does not alter the Applicable or Relevant and Appropriate Requirements listed in the 1996 ROD.

## STATUTORY DETERMINATIONS

The selected remedy for soil/sludge is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action and is cost-effective. The selected remedy uses excavation, treatment, and removal of contaminated soil/sludge to an appropriate off-site landfill facility. This remedy continues to require ground water monitoring of the attenuation through natural processes of dilution and adsorption to insure effectiveness of the remedial action. Because the contaminants will be removed to below risk-based levels, five-year reviews of the soil remedy would not be required for this remedial action.

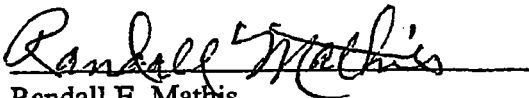
## DATA CERTIFICATION CHECKLIST

The following information is included in the Amendment:

- new remedial action goals for soil/sludge;
- land use that will be available at the Site as a result of the selected remedy;
- duration of the implementation of the remedy; and,
- decisive factors that lead to selecting the remedy.

The following information is included in the previous Record of Decision and other documents in the Administrative Record file:

- chemicals of concern and their respective concentrations;
- baseline risk represented by the chemical of concern;
- basis for the cleanup levels; and,
- current and future ground water uses.



Randall E. Mathis

Director

Arkansas Department of Environmental Quality

September 15, 2000  
Date



Gregg A. Cooke

Regional Administrator

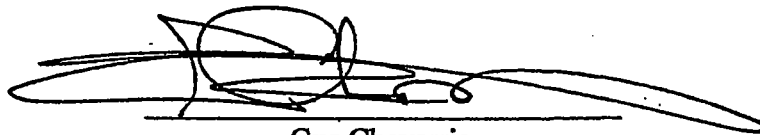
U. S. Environmental Protection Agency

Nov. 9, 00  
Date

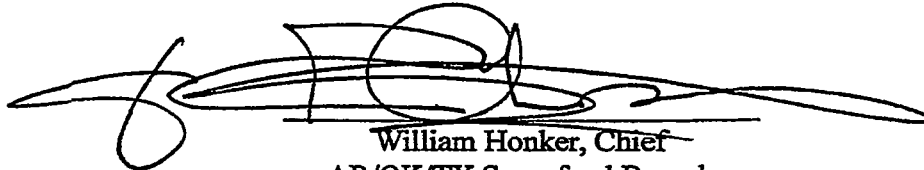
CONCURRENCE LIST  
FOR THE MONROE AUTO PIT SUPERFUND SITE  
(FINCH ROAD LANDFILL)  
PARAGOULD, ARKANSAS  
RECORD OF DECISION  
AMENDMENT NO. 1



Earl Hendrick  
Remedial Project Manager



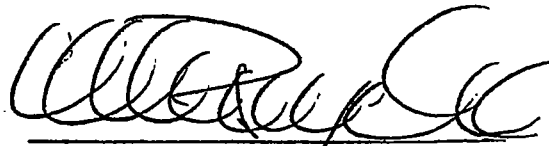
Gus Chavarria  
AR/OK/TX Project Management Section



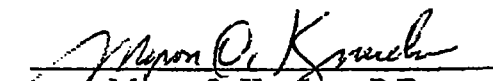
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Office of Regional Counsel

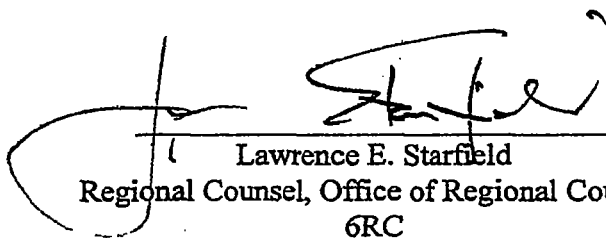


Myron O. Knudson, P.E.  
Director  
Superfund Division

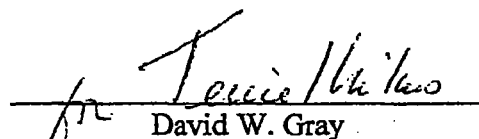
**CONCURRENCE LIST  
FOR THE MONROE AUTO PIT SUPERFUND SITE  
(FINCH ROAD LANDFILL)  
PARAGOULD, ARKANSAS  
RECORD OF DECISION  
AMENDMENT NO. 1**



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**MONROE AUTO PIT SUPERFUND SITE  
(FINCH ROAD LANDFILL)  
PARAGOULD, ARKANSAS  
RECORD OF DECISION  
AMENDMENT NO. 1**

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**MONROE AUTO PIT SUPERFUND SITE  
PARAGOULD, ARKANSAS  
AMENDMENT TO THE RECORD OF DECISION**

**October 2000**

**Summary**

The Arkansas Department of Environmental Quality (ADEQ) has prepared an Amendment (Amendment) to the 1996 Record of Decision (ROD) for the remedial action to be taken at the Monroe Auto Pit Superfund Site (Site) in Paragould, Arkansas. This Amendment changes the remedial action for soil from on-site containment of the contaminated soil/sludge and prohibition of the future use of the Site as specified in the 1996 ROD to excavation and off-site disposal in a secure, licensed landfill facility. This remedy is Alternative 7 described in the 1996 ROD. This Amendment does not alter the remedy that was selected by the 1996 ROD for the monitoring of the ground water attenuation through natural processes of dilution and adsorption. Following the successful implementation of this revised remedy, access controls should not be required but deed restrictions will be necessary to prevent the use of the contaminated ground water at the Site and to allow for ground water monitoring until completion of the ground water remedy. Thus, the Site could have unrestricted use in the future after the ground water remedy is complete.

This amendment specifies the following:

- modification of the remedial action goals for soil as presented in Table 8 of the 1996 ROD to reduce some constituent levels to promote the natural attenuation of the ground water and increase some levels to accommodate existing native soil values;
- excavated uncontaminated soil and imported clean fill may be used as backfill;
- disposal of slightly contaminated soil in a secure landfill licensed to accept such material;
- sludge and highly contaminated soil will be stabilized and stored in a lined containment cell on the Site while the owner applies for delisting of the material;
- after the delisting issue is resolved, the stabilized material will be transported for disposal in a Subtitle D Landfill if delisting is approved, or in a Subtitle C Landfill if delisting is not approved;
- verification of the removal of the contaminated material as defined by the Remedial Soil Actions for Soil presented in this Amended Proposed Action Plan by the analytical testing of the sides and bottom of the excavated area; and,
- monitoring of the ground water to ensure the effectiveness of the remedial action.

This Amendment does not alter the Applicable or Relevant and Appropriate Requirements (ARARs) listed in the 1996 ROD. The new remedy is consistent with the statements and expressed wishes of the nearby residents, the U.S. Environmental Protection Agency (EPA), and the potentially responsible party. The new remedial action should be completed within six months.

## **Introduction**

This Amendment presents the change to the remedy for the Monroe Auto Pit Superfund Site located in Paragould, Arkansas.

The ADEQ is the lead agency for implementing the remedial action at this Site.

The 1996 ROD was signed by the Director of the ADEQ and also by the Deputy Regional Administrator of EPA Region 6 on September 26, 1996. The 1996 ROD called for on-site containment of the contaminated soil/sludge and the prohibition of the future use of the Site. This Amendment changes the remedy to excavation of the sludge and contaminated soil, treatment as required by the Resource Conservation and Recovery Act (RCRA) for removal from the Site and disposal in an off-site licensed landfill facility. This new remedy should allow for the eventual unrestricted use of the Site. After successful implementation of the new remedy access controls should not be necessary. Deed restrictions should not be necessary following the successful completion of both this action and the monitored natural attenuation of the ground water. This new soil remedy does not alter the previously selected ground water remedy.

The ADEQ is issuing this Amendment as part of its public participation responsibilities as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Section 117 and the National Oil and Hazardous Substances Contingency Plan (NCP), 40 CFR, Section 300.435(c)(2)(ii). The purposes of the Amendment are as follow:

- to identify the preferred alternative and explain the rationale for change;
- to describe other remedial options considered; and,
- to serve as a companion to the Remedial Investigation/Feasibility Study (RI/FS) Report and Administrative Record File.

This Amendment uses information that can be found in greater detail in documents contained in the RI/FS and the Administrative Record for the Site. The development and evaluation of the remedial alternative are based on data presented in the original RI/FS and in the 1996 ROD. Since this Amendment alters only the method of remediation and does not decrease the quality of the remediation, no additional institutional controls are required. The new remedy provides the opportunity for the Site to be reused. This Amendment will become part of the Administrative Record file as required by the NCP 300.825(a)(2). The Administrative Record is available at the information repositories listed in Appendix A.

## **Site Description and Background**

The Monroe Auto Pit Superfund Site, also known as the Finch Road Landfill, is located in northeastern Arkansas in an unincorporated portion of Greene County, approximately three miles southwest of Paragould. The Site lies immediately west of Arkansas Highway 358, approximately three miles west of its intersection with U.S. Highway 49. The Site lies in the Northwest Quarter



of the Northeast Quarter of Section 17, Township 16 North, Range 5 East, in the Paragould West 7½-minute quadrangle. The southwestern corner of the Site is at latitude 36° 01' 0" and longitude 90° 34' 30". The maps on pages 4 and 5 show the location and the topography of the Site respectively.

The Site is owned by Tenneco Automotive, Inc., successor to Monroe Auto Equipment Company, One International Drive, Monroe, Michigan. The property is identified as parcel no. 4071-1 in the Greene County Tax Assessor's office. The legal description provided in the property deed is "all that part of the South Half of the Northwest Quarter of the Northeast Quarter of Section 17, Township 16 North, Range 5 East lying West of the Highway No. 358" (Warranty Deed 1973).

In 1973, Monroe purchased the seven-acre tract of land in Greene County, Arkansas. The Site included an inactive sand and gravel borrow pit. Approximately 15,400 cubic yards of alum and lime electroplating sludge/slurry from the waste water treatment lagoons at Monroe's Paragould manufacturing plant were deposited in the borrow pit between 1973 and 1978.

Based on 21 boring samples taken in the sludge disposal area of the Site, the sludge extends to a maximum depth of 30 feet. The greatest contaminant concentrations and the majority of the sludge occur in an approximate interval of five to 25 feet below the surface.

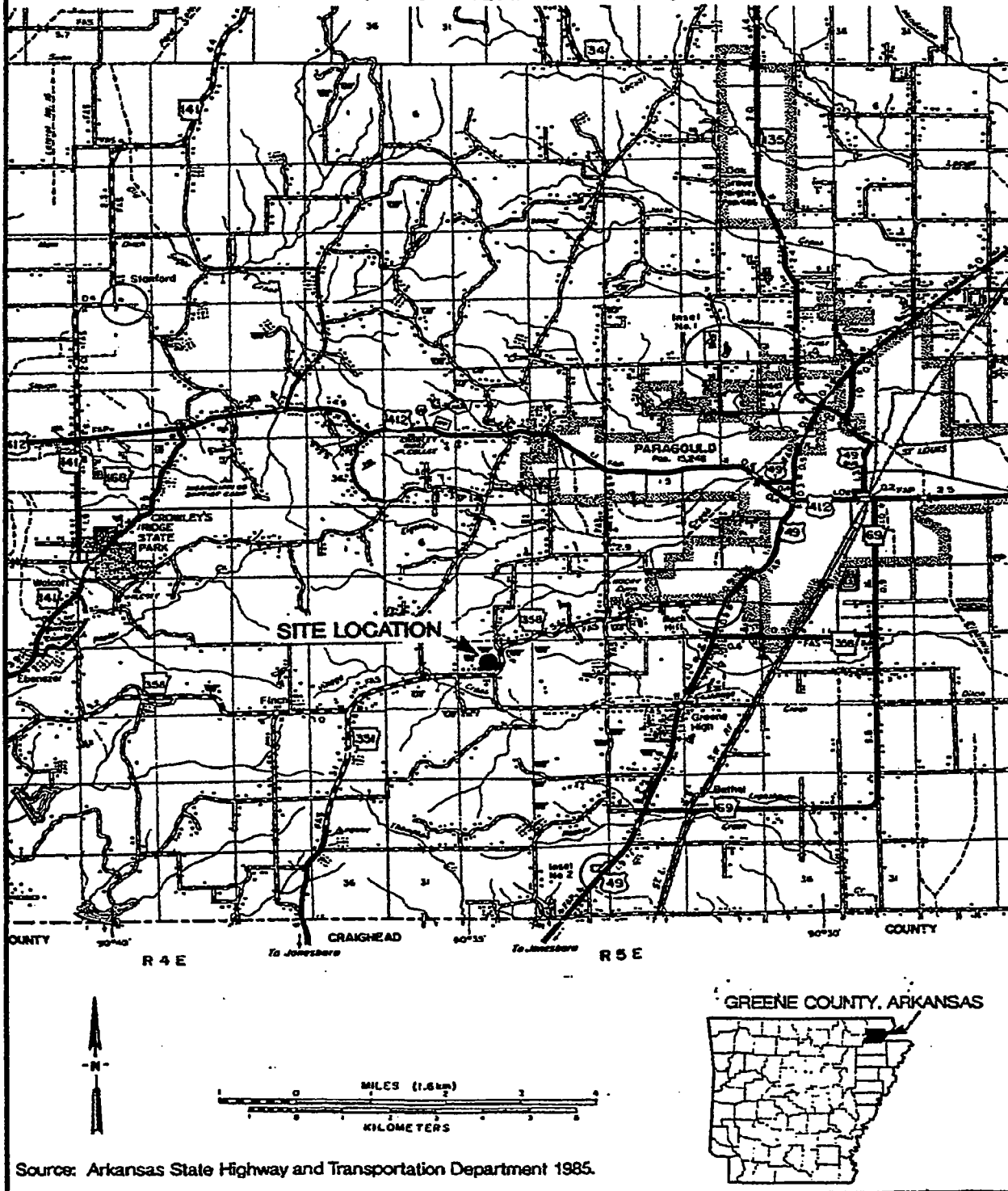
Approximately four acres of the Monroe property, including the sludge disposal area that covers less than one acre of the Site, are surrounded by a six-foot tall chain-link fence topped with barbed wire. The sludge is covered with approximately three to five feet of soil. The Site has remained inactive since 1978. Access is controlled by the fence and a locked gate. The remaining three acres within the fence are, for the most part, cleared of trees and covered with native vegetation.

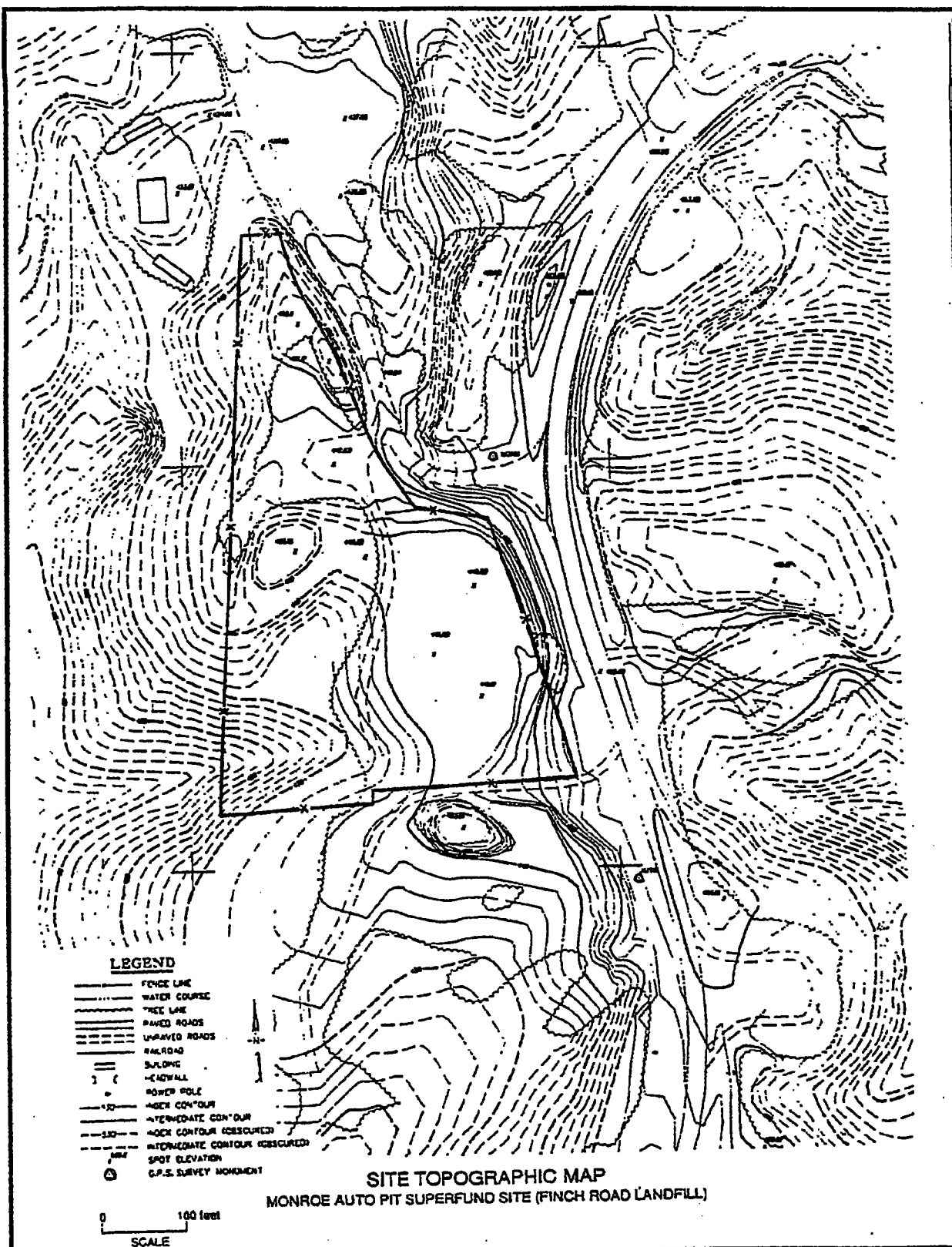
Under ADEQ review, Monroe conducted a series of investigations at the Site between 1979 and 1990. These included the installation of ground water monitoring wells, sampling and analysis of ground water, soil, surface water, and sediment, and the conducting of geological surveys. Analysis of the samples collected from monitoring wells at the landfill indicated the presence of 1,1-Dichloroethane [100µg/L (1989)] and 1,2-Dichloroethylene [750µg/L (1988)]. Furthermore, a residential well (Gann well) located near the Site also showed 1,1-Dichloroethane [10µg/L (1987)] and 1,2-Dichloroethylene [145µg/L (1987)].

The EPA proposed that the Site be added to the National Priorities List (NPL) in 1989. In August 1990, the Site was added to the NPL. A Potentially Responsible Party (PRP) search conducted in 1990 under CERCLA Section 104(e) 42 U.S.C. §9604(e), indicated that Monroe Auto Equipment was the only PRP for this Site. On March 14, 1991, the EPA issued notice of an impending Remedial Investigation and Feasibility Study to the PRP. Monroe Auto Equipment responded to the notice with a good faith offer to perform the RI/FS for this Site. On June 28, 1991, EPA and Monroe Auto Equipment entered into an Administrative Order on Consent for Monroe to perform the RI/FS.

## SITE LOCATION

### MONROE AUTO PIT SUPERFUND SITE (FINCH ROAD LANDFILL)





The EPA and the ADEQ signed the Record of Decision in September 1996, requiring a cap, a 30-foot deep french drain with gravel fill installed up to the ground surface, and access and deed restrictions. The containment and the restrictions would have eliminated the risk of long-term contact with contaminated media left in place. The deed restrictions would prohibit future development of the Site. A survey plat indicating the location of the waste disposal area with respect to permanently surveyed benchmarks was to be prepared and filed with the local zoning authority.

The remedial objective that is addressed in this Amendment is the reduction or elimination of the actual and/or potential risk associated with the sludge pit and the contaminants in the ground water.

### **Basis for This Document**

#### ***Reason for Issuing the Amendment to the Record of Decision***

The primary reason for issuing this Amendment is to identify and describe the rationale for the modification to the remedy at this Site. Included in this Amendment is a comparison of the proposed remedy to the remedy selected in the 1996 ROD. With strong community opinion in favor of removal of sludge and contaminated soil from the Site to an off-site landfill, ADEQ and the Potential Responsible Party (PRP), Tenneco Automotive, Inc., gave preference to the off-site remedy. The PRP has volunteered to finance the revised remedy even though the revised remedy may be more costly than the original remedy.

#### ***Performance Standards***

The Performance Standards specified in the 1996 ROD remain unchanged. These standards include Remedial Action objectives, standards of control, and other substantive requirements (e.g., Applicable or Relevant and Appropriate Requirements - ARARS), criteria, and limitations set forth in the 1996 ROD. However, some of the Remediation Action Goals for Soil would be altered by this Amendment. Because the remedy in the 1996 ROD did not require excavation of contaminated soil, the various metal concentrations that are in the local soil were not considered nor were the reductions in the contaminants to promote ground water through monitored natural attenuation considered. These items are now included in Table 1 - Remediation Action Goals for Soil on page 8 of this Amendment.

### **1996 ROD Remedy**

The following are major components of the soil/sludge remedy selected in the 1996 ROD:

1. installing a french drain around the area of sludge deposits to intercept perched ground water before it enters the contaminated area. The captured ground water would be transported via buried piping to a discharge point located in the intermittent stream southwest of the Site;
2. capping the sludge disposal area in accordance with RCRA Subtitle C requirements;
3. prohibiting future development of the Site; and,
4. conducting environmental monitoring to ensure effectiveness of the remedial action.

## **Description of the New Remedy**

The remedy selected in the 1996 ROD did not require treatment of contaminated soil/sludge, but did require containment to address the threat or potential threat to human health and the environment. The new remedy requires treatment of the contaminated soil/sludge that poses a threat or potential threat to human health and the environment. The treated material will be transported off the Site to a licensed landfill facility. Soil removed from the excavation area that is not contaminated above the remedial action goals and other clean soil may be used as backfill. Soil removed from the excavation area that is contaminated above the remedial action goals for soil, but not requiring treatment under RCRA, will be transported to and disposed of in a secure landfill licensed to accept such material.

In addition, other features of the Amendment are as follows:

1. implementation of this remedy should take less than six months;
2. this alternative remedial action may cost more than the original remedy but the potentially responsible party has volunteered to finance the total cost of the new remedy; and,
3. since contaminants will be removed to below risk-based levels, five-year reviews of the soil remedy will not be required.

## **Classification of Contaminated Soil**

Table 8 of the 1996 ROD lists the Remedial Action Target Goals for Soil/Sludge and Ground Water. This Amendment to the ROD revises and updates the clean-up goals for the soil/sludge. The updated Table 1 below adds permissible values for cyanides, copper, mercury, nickel, and silver. It increases the permissible value for beryllium to recognize the concentrations of beryllium already existing in the native soil near but outside the area of the disposal pit contamination, increases the permissible value of arsenic with the application of the Dilution/Attenuation Factor (DAF),  $DAF = 10$  (values explained below), and reduces permissible values of antimony, chromium, lead, trichloroethylene, and vinyl chlorine in order to promote quicker natural attenuation of the contaminated ground water. The permissible value for cadmium remains unchanged.

The ADEQ uses the DAF that has been developed for the purpose of promoting the natural attenuation of the ground water. The DAF is defined as the ratio of contaminant concentration in soil leachate to the concentration in ground water at the receptor point. The DAF is used to back calculate the target soil leachate concentration from an acceptable ground water concentration. As an example, if the acceptable ground water concentration is 0.05 mg/L (milligrams/Liter) and the DAF is 10 (as is the case for this project), the target leachate concentration would be 0.5 mg/L. Presented below are the former clean up goals presented in the 1996 ROD, the  $DAF = 10$  values, the native soil values, and the resultant new remedial action goals for soil/sludge. The 1996 ROD values for ground water are not altered by this Amendment to ROD.

**TABLE 1 - REMEDIATION ACTION GOALS FOR SOIL**

<b>Constituent</b>	<b>1996 ROD Table 8 Goals</b>	<b>DAF = 10 Values</b>	<b>Native Soil Values</b>	<b>New Remedial Action Goals for Soil/Sludge</b>
Antimony	6 ppm	3 ppm	--	3 ppm
Arsenic	0.02-2 ppm	10 ppm	14 ppm	14 ppm
Beryllium	0.07-7 ppm	30 ppm	0.47 ppm	30 ppm
Cadmium	4 ppm	4 ppm	1.1 ppm	4 ppm
Chromium	3-300 ppm	20 ppm	66 ppm	66 ppm
Cyanides	--	20 ppm	--	20 ppm
Copper	--	--	23 ppm	23 ppm
Lead	500 ppm	1.5 ppm	14 ppm	14 ppm
Mercury	--	0.02 ppm	0.76 ppm	0.76 ppm
Nickel	--	70 ppm	8.1 ppm	70 ppm
Silver	--	20 ppm	--	20 ppm
Trichloroethylene	0.1-10 ppm	0.03 ppm	--	0.03 ppm
Vinyl chloride	20-2000 ppm	0.007 ppm	--	0.007 ppm

**Evaluation of the Original and New Remedies**

The ADEQ uses nine criteria, or standards, to evaluate alternatives for a hazardous waste Site. The following is a comparison of the new remedy and the remedy selected in the 1996 ROD with respect to the nine criteria.

Based on the information currently available, the ADEQ believes the new remedy provides the best balance of tradeoffs among the other alternatives with respect to these evaluation criteria.

**Overall Protection of Human Health and the Environment**

This criterion addresses the way in which a potential remedy would reduce, eliminate, or control the risks posed by the Site to human health and the environment. The method used to achieve an adequate level of protection may be through engineering controls, treatment techniques, or other controls such as restrictions on the future use of the Site. The total elimination of the risk is often impossible to achieve; however, any remedy must minimize risk to assure that human health and the environment will be protected.

Both the original and the new remedies provide adequate protection of human health and the environment by eliminating and preventing risk of exposure: the former through containment of the contaminants at the Site, the latter through treatment and removal of the contaminants from the Site to an off-site licensed landfill facility. However, the new remedy provides greater overall protection of the community because it utilizes treatment of the contaminated sludge and removal of the treated material from the community for disposal to a permitted, secure waste disposal facility.

### ***Applicable or Relevant and Appropriate Requirements***

Compliance with the Applicable or Relevant and Appropriate Requirements (ARARs) assures that a selected remedy will meet all the related Federal, State, and local requirements per Section 121(d) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). The requirements may specify maximum concentrations of contaminants that can remain at the Site; design or performance requirements for treatment technologies; and, restrictions that may limit potential remedial activities at a Site because of its location.

All ARARs contained in the 1996 ROD remain unchanged. Both remedies satisfy the ARARs requirements.

### ***Long-term Effectiveness and Permanence***

This criterion refers to expected residual risk and the ability of a potential remedy to reliably protect human health and the environment over time, after the cleanup levels have been met.

Both remedies achieve long-term effectiveness and permanence. The initial remedy used containment to keep the contaminants from migrating. The new remedy would accomplish the same results by removing the contaminated soil/sludge to an off-site landfill facility, thus providing better long-term effectiveness and permanence than the original remedy.

### ***Reduction in Toxicity, Mobility, or Volume Through Treatment***

This criterion refers to the anticipated performance of the treatment technologies for the remedy. Factors considered include the nature of the treatment process; the amount of hazardous material destroyed by the treatment process; how effectively the process reduces the toxicity, mobility, or volume of waste through treatment; and, the type and quantity of contamination that will remain after treatment.

The original remedy required no treatment of the contaminated soil and sludge. The new remedy requires the contaminated soil and sludge be treated to RCRA requirements for disposal in a secure, licensed landfill facility. Hence, the original remedy would specifically reduce mobility of contaminants at the Site but leave them on the Site. The new remedy would reduce the toxicity, and mobility of waste through treatment at the Site, and would remove the wastes from the Site and deposit the treated wastes into an off-site licensed landfill facility.

### ***Short-term Effectiveness***

This criterion addresses the time factor during implementation of the remedy. A potential remedy is evaluated for the time needed to implement and complete the remedy and any adverse impact on human health and the environment during the construction and implementation of the remedy until cleanup levels are achieved.

Both remedies satisfy this criterion. Both remedies require only a short time to implement and the implementation of either remedy would not have any adverse impact on the community.

### ***Implementability***

Implementability addresses the ease with which a potential remedy can be put in place. Factors such as availability of material and services are considered.

The original remedy and the new remedy are readily implementable. Numerous vendors can conduct either remedy. There are facilities that can receive the treated material.

### ***Cost***

Costs include capital costs required for design and construction, operation and maintenance costs as present worth costs. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Costs are considered and compared to the benefit that will result from implementing the remedy.

The potentially responsible party has volunteered to finance the new remedy even though the new remedy may be more costly than the original remedy.

### ***EPA Acceptance***

EPA acceptance indicates whether, based on its review of documents in the Administrative Record and the Amended Proposed Plan, the EPA concurs with, opposes, or has no comment on the preferred alternative.

ADEQ provided the EPA Region 6 an opportunity to review this Amended Proposed Plan. EPA had no comments on the Amended Proposed Plan and concurs with the new remedy.

### ***Community Acceptance***

The ADEQ recognizes that the community in which a Superfund Site is located is the principal beneficiary of all remedial actions taken. The ADEQ also recognizes that it is responsible for informing interested citizens of the nature of Superfund environmental problems and solutions, and to learn from the community what it desires regarding these sites.

No written comments were received during the thirty-day public comment period (April 19, 2000 through May 22, 2000) for the Amended Proposed Plan. The residents attending the Public Meeting in Paragould on May 11, 2000, expressed their satisfaction with the new remedy. Additionally, the new remedy is consistent with comments and letters received during the public comment period for the July 1995 Proposed Plan and with the opinions expressed by several residents attending a public meeting in Paragould on October 4, 1999.

Based on the information currently available, the ADEQ believes the new remedy meets the threshold criteria and provides the better balance of tradeoffs between the two remedies with respect to the balancing and modifying criteria. The ADEQ expects the new remedy to satisfy the following statutory requirements of CERCLA §121(b): 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; 4) utilize permanent solutions; and, 5) satisfy the preference for treatment as a principal element.



## **Statutory Determinations**

The primary responsibility at Superfund sites is to select remedial actions that are protective of human health and the environment. Section 121 of CERCLA also requires that the selected remedial action comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws, unless a waiver is granted. The selected remedy must be cost-effective and utilize permanent solutions and alternative technologies or resource recovery technologies to the maximum extent practicable. The Statute also contains a preference for remedies which employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as a principal element.

The new remedy is protective of human health and the environment and meets all of the soil and sludge remedial action objectives through treatment and removal of the contaminants from the Site to an off-site licenced landfill facility. It will eliminate the potential of direct contact or ingestion of contaminated soil and will also reduce/eliminate the source of contaminants entering the ground water. The new remedy continues to require ground water monitoring of the attenuation through natural processes of dilution and adsorption to insure effectiveness of the remedial action.

The new remedy satisfies all of the ARARs contained in the 1996 ROD.

The ADEQ believes the new remedy is cost effective for mitigating the direct contact, ingestion, and continued ground water contamination from the Site contaminants. The potentially responsible party has volunteered to finance the new remedy even though it may be more costly than the original remedy.

The new remedy would reduce the toxicity, and mobility of waste through treatment at the Site, and would remove the waste from the Site and deposit the treated waste into an off-site licenced landfill facility. It provides the opportunity for the Site to be reused.

Short term risks associated with the selected remedy can be controlled by proper design and implementation. No adverse cross media impacts are expected from implementation of the selected remedy. The ADEQ believes the new remedy is the remedy most acceptable one to the community.

## **Public Participation Compliance**

On April 19, 2000, the ADEQ issued a notice of the Amended Proposed Plan and established the Public Comment Period to be from April 19 to May 22, 2000. The ADEQ conducted a Public Meeting on May 11, 2000. No written comments were received during the thirty-day public comment period. At this public meeting, all comments were verbal and supported the proposed plan.

### *Documentation of No Significant Change*

Based on the opinion expressed by the residents attending the public meeting in Paragould on May 11, 2000, the ADEQ determined that no changes to the remedy selection, as it was originally identified in the Amendment to the Proposed Plan, were necessary.

## **APPENDIX A**

### **MONROE AUTO SUPERFUND SITE**

#### **LOCATIONS OF REPOSITORIES**

##### **Northeast Arkansas Regional Library**

120 North 12<sup>th</sup> Street  
Paragould, Arkansas 72450  
(870) 236-8711

Hours of Operation: Monday through Thursday 9:00 a.m. - 7:00 p.m.  
Friday and Saturday 9:00 a.m. - 4:00 p.m.

##### **Arkansas Department of Environmental Quality**

Records Section, Management Services Division  
8001 National Drive  
Little Rock, Arkansas  
(501) 682-0744

Hours of Operation: Monday through Friday 8:00 a.m. - 4:30 p.m.

##### **U.S. EPA, Region 6**

7th Floor Reception Area  
Contact Mr Steve Wyman, (214) 665-2792  
1445 Ross Avenue  
Dallas, Texas 75202-2733

Hours of Operation: Monday through Friday 8:00 a.m. - 4:30 p.m.



The Coalition Opposed to PCB  
Ash in Monroe County, Indiana

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## RECORD OF DECISION AMENDMENT

### SOURCE CONTROL OPERABLE UNIT

#### NEAL'S LANDFILL

#### MONROE COUNTY, INDIANA

#### PURPOSE

This decision document presents the source control operable unit remedial action for the Neal's Landfill site and amends the Enforcement Decision Document (EDD), dated August 3, 1984. The cleanup remedy for Neal's Landfill has been developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (CERCLA), and, to the extent practicable, the National Oil Hazardous Substances Pollution Contingency Plan (NCP) and Agency Policy.

The State of Indiana concurs with the cleanup decision in the Record of Decision (ROD) Amendment.

#### BASIS

The decision to amend the Neal's Landfill EDD and to select a modified remedial action for source control is based upon the administrative record for the site. The attached indexes lists the items that comprise the administrative record for the ROD Amendment.

#### ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from Neal's Landfill, if not addressed by implementing the response action selected in this ROD Amendment, may present an imminent and substantial endangerment to public health, welfare, or the environment.

#### DESCRIPTION OF THE MODIFIED REMEDY

The original remedy for Neal's Landfill called for the excavation of 320,000 cubic yards of polychlorinated biphenyls (PCBs) contaminated landfill material and treatment through the construction of a permitted, Toxic Substances Control Act (TSCA) approved, municipal solid waste-fired incinerator. The modified remedy for the source control operable unit at Neal's Landfill consists of the following:

Excavation and removal of selected areas of contamination (referred to as "hot

spots") contaminated with greater than 500 ppm PCBs, and disposal of the excavated landfill soils and materials in a TSCA approved commercial chemical waste landfill. The estimated volume of material to be excavated is 7,000 cubic yards of material.

An additional 41,000 cubic yards of soil and materials will be excavated and sampled to determine if the excavated soil and materials are contaminated with greater than 500 ppm PCBs. If the excavated soil and materials are contaminated with greater than 500 ppm PCBs, then the soil and materials will be disposed of off-site in a TSCA approved commercial chemical waste landfill. If the excavated soil and materials are contaminated with less than 500 ppm PCBs, then the material will be consolidated on the elevated rock surface in the center part of the landfill and capped.

The current 18-acre landfill footprint will be reduced to 10-acres by consolidation of excavated soils and materials contaminated with less than 500 ppm PCBs on the elevated rock surface in the center part of the landfill. It is anticipated that through this consolidation the possibility of back-flooding of PCB contaminated soil and materials will be reduced and perhaps eliminated.

All visible PCB contamination, such as capacitors, capacitor parts, and oil-stained soil and material shall be excavated from the landfill and disposed of at, or treated in, an offsite facility. Pursuant to Toxic Substances Control Act (TSCA) requirements, capacitors containing PCB oil and any free oil will be incinerated in a TSCA compliant incinerator. Also, eight locations have been identified where capacitors were reburied during the interim action and these capacitors will be excavated and disposed of by off-site incineration if they contain PCB oil.

Construction of a RCRA Subtitle C compliant cap meeting the permeability requirements of  $1 \times 10^{-7}$  cm/sec placed over the consolidated 10-acre landfill to address the low level threat wastes remaining.

Areas outside the landfill cap and within the Site fence line may contain levels of up to 25 ppm PCBs on average with a maximum value of 50 ppm, but must be covered with 6 inches of clean soil cover. Areas located in drainage waterways outside the cap will be remediated to 1 ppm PCBs. Although no known areas outside the fence at Neal's Landfill are contaminated, if it appears that contamination is present outside the fence line, the area will be remediated to residential/high occupancy PCB standard of 5 ppm with a 6-inch soil cover.

Development of a long-term inspection and maintenance plan for the landfill cap along with a groundwater and surface water monitoring program for governmental parties approval.

### **STATUTORY DETERMINATIONS**

The selected source control interim action is protective of human health and the environment, complies with Federal and State applicable or relevant and appropriate requirements directly associated with this action, and is cost effective. This action uses permanent solutions and alternative treatment technologies to the maximum

extent practicable, given the scope of the action. Treatment by off-site incineration of PCB oil filled capacitors is included as part of the remedy thereby, meeting the requirement of reduction in toxicity, mobility, or volume through treatment. Off-site landfilling of PCB contaminated landfill material does not reduce the toxicity, mobility, or volume through treatment but is justified based upon the large quantities of municipal landfill waste disposed of at the site along with the court mandated deadline and community opposition to on-site thermal treatment. The low level threat waste remaining on-site will be contained under a RCRA Subtitle C compliant cap.

The source control operable unit remedial action selected in the ROD Amendment does result in hazardous substances remaining on-site above health-based levels but these will be contained under a landfill cap. Subsequent actions are planned to address fully the principal threats posed by this site. Future remedial decisions will be made regarding additional interim and final water treatment and sediment removal. A long-term inspection and maintenance plan along with a groundwater and surface water monitoring plan will be implemented. A Five-Year Review will be conducted after commencement of the remedial action to ensure that residual PCBs do not pose a threat to public health and the environment.

William E. Muno, Director

Superfund Division

## **RECORD DECISION AMENDMENT**

### **Source Control Operable Unit**

#### **Neal's Landfill**

#### **Monroe County, Indiana**

### **1. INTRODUCTION**

This Record of Decision (ROD) Amendment changes the original remedial action for Neal's Landfill, as described in the Enforcement Decision Document (EDD), dated August 3, 1984, and as further memorialized in the settlement in U.S. v. Westinghouse Electric Corporation, Civil Action Nos. IP 83-9-C and IP 81-448, consolidated, and entered by the U.S. District Court for the Southern District of Indiana in 1985 (the "Consent Decree"). Pursuant to Comprehensive Environmental Response, Compensation and Liability Act CERCLA Section 117 and the National Contingency Plan (NCP), Section 300.435(c)(2)(ii), the United States Environmental Protection Agency (U.S. EPA) is publishing notification of availability of this ROD Amendment. A Proposed Plan was published on December 21, 1998 followed by a 45 day public comment period which ended on February 3, 1999. This ROD Amendment will become part of the Administrative Record for Neal's Landfill pursuant to NCP Section 300.825(a)(2). The Administrative Record for this site is

available for review at the offices of the United States Environmental Protection Agency (U.S. EPA), 77 West Jackson, Chicago, Illinois or the Monroe County Public Library, Indiana Room, 303 E. Kirkwood, Bloomington, Indiana.

The alternative remedial action selected in this ROD Amendment is only for the Source Control Operable Unit and future remedial decisions will be published for water treatment at Neal's Landfill and sediment removal in Conards Branch and Richland Creek. This source control operable unit remedy addresses the principle threats posed by the landfill through removal of selected areas of soil and materials contaminated with equal to or greater than 500 parts per million (ppm) polychlorinated biphenyls (PCBs), and referred to in this document as "hot spots". The remaining lower level threat wastes will be consolidated on-site and covered with a cap.

Neal's Landfill is located just west of Bloomington, Indiana (See Figure 1) and operated as a sanitary landfill from 1950 to 1972. In 1966 and 1967, PCB filled capacitors and PCB contaminated rags, sawdust, and filter clay used in the manufacture of capacitors were disposed of at the landfill. It is estimated that between 10,000 and 40,000 capacitors were disposed of at the site. Extensive on-site salvaging of capacitors for the metal components also occurred at the Site. The landfill is approximately 18 acres in size. Mr. Ray Neal, the previous owner and operator of the landfill, hauled PCB-contaminated capacitors and materials to Neal's Landfill under contract from Westinghouse, now known as CBS Corporation (CBS). Mr. Ray Neal owned the site until 1977. From 1977 to 1980, the site was owned by Mr. Richard Neal. The site is now owned by the Taylor Farm Limited Liability Corporation.

Since 1981, numerous field inspections and investigations have been conducted at Neal's Landfill by both U.S. EPA and CBS. Sampling included sediment/surface water sampling in Conard's Branch and Richland Creek, springs located near the landfill, soils on-site, residential wells in the vicinity of the landfill, monitoring wells on-site and off-site, air monitoring upwind and downwind of the landfill, and sampling of vegetation and fish in Conard's Branch and Richland Creek. The most recent sampling occurred in March/April 1998, when 105 borings were placed within Neal's Landfill. A total of 271 samples were analyzed for PCBs. Values of PCBs ranged from non-detect to 34,796 ppm' PCBs. Figure 2 shows the boring locations within Neal's Landfill and Table 1 shows the locations where levels of PCBs were equal to or greater than 500 ppm.

Pursuant to a Stipulation and Order of Preliminary Injunction, CBS conducted interim remedial measures at Neal's Landfill, which were completed in 1984. The interim remedial measures included the following:

Removal of 122 exposed capacitors and associated contaminated soil with off-site disposal. A total of 80 capacitors at 8 locations were reburied at the site during the interim remedial measures.

Upgrading the cover over the refuse area, including grading and re-vegetating the surface of the landfill. Fencing the perimeter of the site. Performing sediment sampling, aerial photographic interpretations, and water balance calculations.

Placement of sediment filter fences. Construction of diversion ditches.

The 1985 Consent Decree required CBS to complete additional interim remedial measures to protect public health and the environment. These measures included the following:

Sampling of monitoring wells, springs, seeps, and streams both on-site and off-site.

Included in the monitoring were selected residential wells within a 5,000-foot radius of the site

Capture and treatment in an on-site water treatment plant of the combined flows from South Spring, North Spring and Southwest Seep up to 1.0 cubic feet per second (approximately 448 gallons per minute) to an effluent standard of 1 part per billion PCBs.

Installation of erosion control fencing.

Posting of PCB contamination warning signs along Conard's Branch and Richland Creek which flow through the Conard's farm.

Removal of sediments from Conard's Branch from Neal's Landfill to its confluence with

Richland Creek and within Richland Creek from 25 feet upstream of its confluence with

Conard's Branch to a point 200 feet downstream from the confluence.

' See Neal's Landfill Sampling Report from Tetra Tech, dated November 30, 1998 for complete results from the March/April 1998 sampling event.

Sampling of sediments after remediation and establishing a baseline for future monitoring. Establishment of a vegetative cover over all disturbed areas.

Since completion of the interim remedial measures by CBS, CBS has continued to perform operation and maintenance and monitoring at Neal's Landfill.

## **II. REASONS FOR ISSUING THE ROD AMENDMENT**

On January 4, 1983, the United States filed a civil action against Westinghouse Electric Corporation, now known as CBS Corporation, pursuant to Section 7003 of the Resource Conservation and Recovery Act (RCRA) and Sections 104, 106, and 107 of CERCLA alleging disposal of PCBs at Neal's Landfill and Neal's Dump in the Bloomington area and seeking relief for the contamination resulting from that disposal. During the fall of 1983, CBS expressed its interest in negotiating a



settlement of that suit as well as a civil action filed by the City of Bloomington for improper PCB disposal at two sites owned by the City (the Lemon Lane Landfill and Winston Thomas Wastewater Treatment Plant).

In 1985, U.S. EPA, the Indiana Department of Environmental Management ("IDEM"), Monroe County, and the City of Bloomington (as plaintiffs) entered into a Consent Decree with Westinghouse Electric Corporation ("Westinghouse") for the clean-up of six PCB contaminated sites located in, and around, Bloomington, Indiana. The Consent Decree called for the excavation of nearly 650,000 cubic yards of PCB-contaminated material and the incineration of those materials in a dedicated, two-train, garbage-fired, Toxic Substances Control Act ("TSCA") approved and State permitted incinerator to be built and operated by Westinghouse - the sole Potentially Responsible Party (PRP) responsible as a generator for the PCB contamination. Four of the sites covered by the Consent Decree are NPL sites. Two sites, including Winston-Thomas, are not NPL sites.

After entry of the Consent Decree public opposition to the incinerator rose. Applications of the necessary permits to design and build the incinerator were submitted by Westinghouse in 1991. Beginning in 1991, the Indiana State Legislature passed several laws intended to delay and block the implementation of the incineration remedy required in the 1985 Consent Decree. In February 1994, the parties agreed to jointly explore, under the Operating Principals, alternatives to the incineration remedy for the six sites required under the Consent Decree.

In part as a result of the conclusion that the incineration remedy would not be implemented, the parties began adopting response actions, other than incineration, for the sites covered by the Consent Decree. Thus, On May 27, 1997, U.S. EPA issued an action memorandum selecting a response action for certain PCB-contaminated units at Winston-Thomas. The alternative response action consists of excavation of PCB contaminated soil and sludge and disposal in an appropriate, licensed landfill, as well as decontamination and encapsulation on-site of certain concrete digester tank walls.

On June 3, 1997, the United States lodged with the U.S. District Court the first amendment to the Consent Decree, memorializing the agreement of the parties to the Consent Decree to the response action selected in the action memorandum. On August 18, 1997, the Court entered the first amendment thus substituting the response action selected in the action memorandum for certain of the units at Winston-Thomas for the incinerator. Further amendments (or stipulations) for other units at Winston-Thomas, as well as the other Consent Decree sites, have been submitted to the Court as appropriate.

On January 30, 1998, U.S. EPA issued an action memorandum in response to a judicial order issued on November 21, 1997 for the clean-up of the interim storage facility, which stored PCB contaminated soil and sediment from other Bloomington, Indiana, sites. CBS implemented the selected response action upon approval by all of the parties, and with the knowledge of the court, of a work plan.

On May 12, 1998, U.S. EPA issued an action memorandum for the completion of the clean-up of Winston Thomas. The units addressed include the abandoned lagoon,

trickling filter and the tertiary lagoon. The clean-up of the tertiary lagoon, which covers 17 acres and is filled with water, involves dredging of PCB contaminated sludge. All material excavated from the tertiary lagoon and the abandoned lagoon will be landfilled. On May 18, 1998, the United States lodged with the U.S. District Court the stipulation changing the terms of the Consent Decree, and memorializing the agreement of the parties to the Consent Decree to the response action selected in the action memorandum. The changes provide for the clean-up of the largest and most complicated units at Winston Thomas - the abandoned lagoon and the tertiary lagoon. On June 8, 1998, the Court entered the stipulation, thus substituting the response action selected in the action memorandum for certain of the units at Winston-Thomas for the incinerator.

On October 16, 1998, the U.S. EPA issued a ROD Amendment for alternative remedies for both Neal's Dump and Bennett's Quarry. On February 8, 1999, the Court entered an amendment to the Consent Decree memorializing the change to the remedy for Neal's Dump.

Having already adopted a response action other than incineration for Winston-Thomas, Bennett's Quarry, and Neal's Dump and, because the incinerator still has not been constructed and is unavailable to address the PCB contaminated soils and materials, the parties explored alternatives to incineration for Neal's Landfill.

In November 1997, Federal Judge Hugh Dillin issued a judicial order directing the six Consent Decree sites to be remediated by December 1999 and assigned Magistrate Judge Kennard Foster to oversee the progress of the parties toward meeting the December 1999 deadline. On February 1, 1999 Judge Dillin issued a new judicial order directing that the Consent Decree parties have until December 31, 2000 to complete all the source control remedies for the Consent Decree sites. The judicial order also provided for further negotiations between the governmental parties and CBS regarding water treatment, sediment removal, and other matters.

In short, the amendment to the remedial decision at Neal's Landfill is driven in part by the need for an alternative to the incineration remedy since the original proposed incinerator cannot be built in time to dispose of all the materials that are to be excavated and removed from the sites, and in part by the consensus of the Parties that an alternative is necessary. After discussions with the governmental parties and CBS Corporation, the U.S. EPA issued a Proposed Plan for the Neal's Landfill source control operable unit for public comment on December 21, 1998. A public hearing was held in Bloomington, Indiana, on January 27, 1999. The public comment period ended 45 days later on February 3, 1999. The public comments have been considered and are addressed in the Responsiveness Summary that accompanies this ROD Amendment.

### **III. SCOPE AND ROLE OF OPERABLE UNIT**

The U.S. EPA's ROD Amendment addresses the source control operable unit at Neal's Landfill. Further groundwater, surface water and sediment investigations will be conducted to supplement the current information. Once the additional information is available, a second and third operable unit will be implemented, if necessary, to address the principal threat and the release of PCBs from Neal's Landfill and PCB

contamination within Conard's Branch and Richland Creek. The contaminated groundwater which becomes surface water may pose a threat to human health and the environment and will be addressed in Operable Unit 2. Operable Unit 3 will address sediment contaminated with PCBs from Neal's Landfill in Conard's Branch and Richland Creek.

#### **IV. SUMMARY OF SITE RISKS**

Site risks were identified in the August 3, 1984 Enforcement Decision Document (EDD). This ROD Amendment for the Source Control Operable Unit addresses certain, but not all, of the risks identified in the EDD and its supporting materials. Since the date of the EDD, additional information and data have been developed, and are described in this document, which support changing the nature and scope of source control measures. The administrative record for this ROD Amendment includes the supporting information and data.

During the March/April 1998 PCB sampling event, high concentrations of PCBs were discovered within Neal's Landfill. Figure 2 shows the locations and concentrations of PCBs discovered during the investigation. A concentration as high as 34,795 ppm PCBs was found in the investigation. In reviewing the data, a number of areas within the landfill showed high concentrations of PCBs, including areas in the north and southeast portion of the site which are at elevations prone to backflooding. Backflooding provides a migration pathway for PCBs due to PCBs coming into contact with water.

The release and threatened releases of PCBs from Neal's Landfill which have contaminated sediments and groundwater and produced unacceptable risk will be addressed through future operable unit decision documents.

#### **V. DESCRIPTION OF THE NEW ALTERNATIVES**

The original remedial action for Neal's Landfill called for the excavation and incineration of an estimated 320,000 cubic yards of PCB contaminated landfill waste. During discussions with Magistrate Judge Foster regarding sampling within Neal's Landfill for PCBs, a disagreement arose between CBS and the governmental parties regarding the scope and extent of the sampling within Neal's Landfill. On February 13, 1998, Magistrate Judge Foster issued a judicial order requiring CBS to complete its proposed sampling within Neal's Landfill of 13 borings in the southeast corner of the site and for U.S. EPA to complete 78 borings over the remainder of the landfill. This sampling was completed in March/April 1998 and, based upon the March/April 1998 sampling event, five remedial alternatives were identified for the source control operable unit. The alternatives were developed by the U.S. EPA in consultation with the other governmental parties and ranged from no action to complete excavation.

In the Record of Decision Amendment for Bennett's Quarry and Neal's Dump, U.S. EPA, in consultation with the other governmental parties, evaluated three landfill disposal options for materials containing, or contaminated with, PCBs. The three disposal options included constructing a chemical waste landfill at Bottom Road, placing the PCB-contaminated material from the Consent Decree sites on top of Neal's Landfill and off-site disposal in a chemical waste landfill. In evaluating the

disposal options for both Neal's Dump and Bennett's Quarry, the U.S. EPA determined that off-site disposal of excavated PCB-contaminated soils and materials in a chemical waste landfill was the best alternative. During discussions with the other governmental parties and CBS regarding the disposal option alternatives for Neal's Landfill, it was agreed that disposal in an off-site TSCA-approved, commercial, chemical waste landfill was appropriate and that local disposal would not be considered.

### Neal's Landfill Alternatives

For the reasons already discussed, the incineration remedy originally called for is not a viable treatment alternative for the PCB contaminated soil and materials at Neal's Landfill. Accordingly, although the incineration remedy would have satisfied the nine criteria had it been built, under current conditions the incineration remedy fails to meet the implementability, community acceptance, and State acceptance criteria. Because the incinerator currently does not exist and in light of the court mandated deadline, the following discussion of the source control alternatives excludes incineration as contemplated in the Consent Decree.

#### **Alternative 1 - No Action**

The "no action" alternative would leave the Neal's Landfill interim cap in place without modifications and would not require the removal of PCB-contaminated soils and materials. CBS would develop a long-term monitoring plan that would be subject to the approval of governmental parties approval for monitoring groundwater and surface water at and near Neal's Landfill.

#### **Alternative 2 - Construction of a RCRA Subtitle C Compliant Cap Over the Landfill Surface.**

Alternative 2 consists of construction of a Resource Conservation Recovery Act (RCRA) Subtitle C compliant cap over the entire existing 1 8-acre landfill. A Subtitle C compliant cap consists of a multi-layer design and meets the requirements of 40 CFR Part 264.300. The RCRA Subtitle C compliant cap must meet a permeability requirement of less than  $1 \times 10^{-7}$  centimeters per second and conceptually, the cap consists of 6-inches of top soil, 2-feet of clean fill to prevent the clay layer from being affected by frost, a drainage layer, a minimum of 40 mil flexible membrane liner and 2-feet of compacted clay. Areas outside the 1 8-acre landfill cap, but within the fence line of the Site, may contain PCB levels at 25 ppm PCBs on average, with a maximum value of 50 ppm PCBs with a 6-inch soil cover.

There are a number of naturally occurring drainage waterways running through the landfill, as well as in the immediate vicinity of the landfill. Naturally occurring drainage waterways that lie outside of the RCRA Subtitle C landfill cap will be sampled and remediated to 1 ppm PCBs to address the possibility of transport of PCBs from the drainage waterways. Further, additional drainage waterways will be constructed to control water run-off from the landfill and the surrounding areas. These drainage waterways outside the RCRA Subtitle C cap also will be sampled and remediated to 1 ppm PCBs to address the possibility of transport of PCBs from the drainage waterways. Although there are no known contaminated areas outside

the fence at Neal's Landfill, if it appears that contamination is present outside the fence line, those areas will be remediated to residential/high occupancy PCB standard of 5 ppm with a 6-inch soil cover. CBS will be required to develop a long-term inspection and maintenance plan for the landfill cap along with a groundwater and surface water monitoring program for governmental parties approval.

**Alternative 3 - Excavation of "Hot Spots" Equal to or Greater Than 500 parts per million PCBs with Off-site Disposal and Placement of a RCRA Subtitle C compliant Cap over the Landfill Surface**

Alternative 3 consists of removing selected areas of contamination, referred to as "hot spots", contaminated with equal to or greater than 500 ppm PCBs and disposal of the excavated "hot spot" soils and materials in a TSCA-approved, commercial chemical waste landfill capable of accepting PCB materials contaminated at levels equal to or greater than 500 ppm PCBs. The 500 ppm PCBs value was determined to be a principal threat based on U.S. EPA PCB guidance. Soil and materials contaminated with equal to or greater than 500 ppm PCBs would be considered source material. Source material is defined as material that can act as a reservoir for migration of contamination to groundwater or surface water. Table 1 shows the boring locations where contamination level of equal to or greater than 500 ppm PCBs were disclosed. The large volume of landfill material contaminated with less than 500 ppm PCBs is considered a low level threat and will be addressed in this operable unit through containment.

Figure 3 shows the locations of the PCB "hot spots" contaminated with equal to or greater than 500 ppm PCBs, based upon the March/April 1998 sampling event at Neal's Landfill. The estimated volume of material to be excavated and disposed of off-site is 7,000 cubic yards of material. In addition, all visible contamination, such as capacitors, capacitor parts, and oilstained material shall be excavated from the landfill and disposed of at, or treated in, an off-site facility. Pursuant to TSCA, capacitors containing PCB oil, and all free oil, must be incinerated in a TSCA approved incinerator pursuant to 40 CFR 761.70. In addition to removal and off-site disposal of the areas contaminated with equal to or greater than 500 ppm PCB, a RCRA Subtitle C compliant cap, as described in Alternative 2 and meeting the permeability requirements of  $1 \times 10^{-7}$  cm/sec, will be placed over the entire 18-acre landfill to address the low level threat wastes remaining. Also, eight locations have been identified where capacitors were reburied during the interim action and these capacitors will be excavated and disposed of through off-site incineration if they contain PCB oil.

Areas outside the landfill cap, but still within the Site fence line, may contain levels of 25 ppm PCBs on average with a maximum value of 50 ppm, but must have a 6-inch soil cover. As described in Alternative 2, areas located in drainage waterways (both naturally occurring and man made) outside the cap will be remediated to 1 ppm PCBs. Even though no known areas outside the Site fence are contaminated with PCBs, if it is discovered that contamination is present outside the fence line, the area will be remediated to residential/high occupancy PCB standard of 5 ppm PCBs, and covered with a 6-inch clean-soil cover. CBS will be required to develop a long-term inspection and maintenance plan for the landfill cap along with a groundwater and surface water monitoring program for governmental parties approval.

**Alternative 4 – Excavation of "Hot Spots" Contaminated with Equal to or Greater than 500 ppm PCBs with Off-site Disposal, Consolidation of Landfill Material to the Center Portion of the Landfill and Placement of a RCRA Subtitle C Compliant Cap over the Reduced Landfill Surface**

This alternative consists of excavating and removing 7000 cubic yards of material estimated to be contaminated with equal to or greater than 500 ppm PCBs as described in Alternative 3. In addition to the excavation and disposal of the identified "hot spot" areas, the March/April 1998 sampling suggest that other, additional landfill areas may contain PCB contamination at levels equal to or greater than 500 ppm PCBs. The contour lines drawn in Figure 4 represent possible areas equal to or greater than 500 ppm PCBs and those areas will be excavated and sampled. The estimated volume of material within the contours is 41,000 cubic yards and this material will be sampled to determine if material is contaminated with equal to or greater than 500 ppm PCBs. If sampling demonstrates that the material is contaminated with equal to or greater than 500 ppm PCBs, then this material will be disposed of off-site in a TSCA-approved commercial chemical waste landfill. If the sampling establishes that the material is contaminated with less than 500 ppm PCBs, then the material may be consolidated on the elevated rock surface in the center part of the landfill. For cost purposes, EPA estimates that 13,000 cubic yards of material will be taken off-site for disposal, in addition to the 7,000 cubic yards described above. Based upon the PCB sampling and analysis, the volume of material disposed of off-site in a off-site commercial chemical waste landfill is between 7000 cubic yards and 48,000 cubic yards. As described in Alternatives 2 and 3, all visible contamination, such as capacitors, capacitor parts and oil-stained material shall be excavated from the Site and disposed of at, or treated in, an off-site facility. Pursuant to TSCA, capacitors containing PCB oil and all free oil must be incinerated in a TSCA compliant incinerator pursuant to 40 CFR 761.70.

The natural geology of Neal's Landfill is such that the center portion of the site is a bedrock ridge that is at an elevation less prone to backflooding. Backflooding occurs when water from rain events travels through the underground karst conduits at the Site and the water backs up within those conduits. The water is forced to the surface and, in the case of Neal's Landfill, the lower-lying landfill material becomes saturated. The saturation with water of the PCB contaminated soils and materials in the Site makes migration of PCB material from the landfill more likely. The southeast portion of Neal's Landfill and the area north of the current landfill slope may be subjected to backflooding. These conclusions are based on physical observations and the measured elevations of the ground surface at those locations.

The southeast portion of the landfill below the contours shown in Figure 4 and the area defined north of the slope will be excavated and consolidated on top of the higher, bedrock, center portion of the site. Excavation of these areas and the consolidation of the excavated soils and materials will decrease the landfill's size from the current 18-acres to 10-acres. A conceptual footprint of the 10-acre landfill along with the elevation of the rock surface is shown in Figure 5. The 10-acre landfill footprint covers an area that is less prone to backflooding than the current Site footprint. A RCRA Subtitle C compliant cap will be placed over the entire 10-acre consolidated landfill. The cap will meet the RCRA Subtitle C landfill cap permeability requirements of less than  $1 \times 10^{-7}$  cm/sec. The cap is conceptually described in

Alternative 2. Also, eight locations have been identified as areas where capacitors were reburied during the interim action and these capacitors will be excavated and disposed of by incineration.

Areas outside the landfill cap, but within the current fence line, must be remediated to an low occupancy/industrial PCB cleanup standard. Using 40 CFR 761.61, a cleanup value of 25 ppm on average with a maximum allowed value of 50 ppm is appropriate with a 6-inch clean-soil cover. As described in Alternative 2, areas located in drainage waterways (both naturally occurring and man-made) outside the cap will be remediated to 1 ppm PCBs. Even though no known areas outside the Site fence are contaminated with PCBs, if it is discovered that contamination is present outside the current fence line, the area will be remediated, pursuant to 40 CFR 761.61, to residential/high occupancy PCB standard of 5 ppm PCBs and covered with a 6-inch clean-soil cover. CBS will be required to develop a long-term inspection and maintenance plan for the landfill cap along with a groundwater and surface water monitoring program for governmental parties approval.

After consolidation on the elevated rock surface in the center part of the landfill and capping of the consolidated area, a new fence may be erected around the perimeter of the new, smaller

landfill footprint. With appropriate deed restrictions limiting use of the areas outside of the new, smaller landfill footprint to industrial/low occupancy uses, then the existing fence surrounding the Site may be removed.

**Alternative 5** - Total Excavation of Neal's Landfill to a Residual PCB Level of 25 ppm and Placement of a Soil Cover Over the Excavated Area.

In this alternative, the entire landfill would be excavated to industrial cleanup standard of 25 ppm PCBs on average and the excavated soils and materials disposed of off-site. The capacitors will again be excavated and disposed of by incineration. The remaining soils with PCBs on average of less than 25 ppm would be covered with a minimum of a 10-inch soil cover. Under this alternative, the estimated volume of material to be excavated is 320,000 cubic yards. A groundwater and surface water monitoring plan would be developed and would continue for a least 5 years. As part of the Five-Year Review process the monitoring program will be reevaluated and either discontinued, continued, or modified and continued as modified.

With respect to each of these alternatives, if hazardous substances are left on-site, appropriate deed restrictions will be required.

## VI. EVALUATION OF ALTERNATIVES

The U.S. EPA uses nine evaluation criteria as set forth in the National Contingency Plan, 40 CFR Part 300.430, to evaluate the fundamental change and the different alternatives associated with the change in remedy. The selected alternative is the alternative for each fundamental change that complies with Criteria 1 and 2, achieves the best balance among Criteria 3-7, and considers Criteria 8 and 9.

The nine evaluation criteria are listed below:

**Criteria 1** - Overall Protection of Human Health and Environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

**Criteria 2** - Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) addresses whether or not a remedy will meet all other Federal and State environmental statutes and/or provide grounds for issuing a waiver.

**Criteria 3** - Long-Term Effectiveness and Permanence refers to the amount of risk remaining at a site and the ability of a new remedy to maintain reliable protection of human health and the environment over time once cleanup standards have been met.

**Criteria 4** - Reduction of Toxicity, Mobility, or Volume through Treatment is the anticipated

performance of the treatment technologies that may be employed in a remedy.

**Criteria 5** - Short-Term Effectiveness refers to the speed with which the remedy achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment that may result during the construction and implementation period.

**Criteria 6** - Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution.

**Criteria 7** - Cost addresses the estimated capital and operation and maintenance costs, as well as present-worth cost. Present worth is the total cost of an alternative in terms of today's dollars.

**Criteria 8** - Support Agency Acceptance indicates whether, based on its review of the ROD Amendment, the support agency (usually a state environmental agency) concurs with, opposes or has no comment on the recommended alternative.

**Criteria 9** - Community Acceptance is assessed in the Record of Decision following a review of the public comments received on the Proposed Plan Amendment.

Five alternatives were evaluated against the nine criteria for the remediation of Neal's Landfill. The No Action Alternative does not comply with the criteria of overall protection of human health and the environment and compliance with applicable or relevant and appropriate requirements and will not be evaluated further.

### **Overall Protection of Human Health and Environment**



Alternatives 2 through 5 all are protective of human health and the environment for the Source Control Operable Unit at Neal's Landfill. Alternative 5 would be the most protective since complete removal of PCB landfill material to 25 ppm PCBs occurs. Alternative 3 is more protective than 2 due to the hot spot removal. Alternative 4 would be more protective than Alternative 2 or 3 since material equal to or greater than 500 ppm PCBs will be disposed of off-site and large quantities of low level PCB contaminated landfill material will be consolidated to areas which are less prone to backflooding, thereby limiting the migration of PCBs from the landfill. It is important to note that none of the Alternatives are protective overall without further consideration of water treatment for the springs and sediment removal in Conard's Branch and Richland Creek.

### **Compliance with Applicable or Relevant and Appropriate Requirements**

Alternatives 2 through 5 for the source control operable unit at Neal's Landfill must meet ARARs, unless an ARAR waiver under CERCLA Section 121 (d)(4) is obtained. In this case, no ARAR waivers are anticipated for the four alternatives. Under TSCA, small capacitors, defined as containing less than 3 pounds of PCBs (40 CFR 761.3), and filled with PCB oil, can be disposed of in a municipal landfill (40 CFR 761.60). On the other hand, large capacitors (40 CFR 761.3) must be incinerated (40 CFR 761.60). It is anticipated that mainly large capacitors will be present at Neal's Landfill. It is unknown if the capacitors will be filled with PCB containing oil or if the capacitors will be empty. There is environmental benefit to disposing small PCB oil-filled capacitors in a TSCA approved compliant landfill, and CBS does not object to this requirements with respect to small capacitors. PCB-contaminated soils and materials excavated from the two sites can be landfilled in TSCA approved and compliant landfill. Consistent with TSCA, large and small capacitor carcasses that are broken or cracked open, and do not contain any PCB oil, constitute debris and are not capacitors within the meaning of 40 CFR 761.60, may be disposed of in a TSCA approved and compliant landfill.

### **Long-Term Effectiveness and Permanence**

Comparing Alternatives 2 through 5 for the source control operable unit, Alternative 5 is the most permanent and effective of the four alternatives evaluated even though without further evaluation of water treatment and sediment removal, the long-term effectiveness is limited for all the alternatives. Alternative 5 removes PCB contaminated landfill material to 25 ppm PCBs on average and disposes of the material in a chemical waste landfill along with incinerating the PCB oil and PCB oil-filled capacitors. Alternative 4 removes principal threat PCB landfill material equal to or greater than 500 ppm and takes landfill areas more prone to backflooding and consolidates the landfill material under a RCRA cap. As with Alternative 5, PCB oil and PCB oil filled capacitors will be permanently destroyed by incineration under Alternative 4, though Alternative 5 may incinerate a greater number of capacitors. Alternative 3 will also remove PCB contaminated landfill material to a chemical waste landfill and permanently destroy PCB oil and PCB oil filled capacitors through incineration even though not to the extent of Alternative 5 or Alternative 4. Capping the landfill as described in Alternative 2 and Alternative 3 will not be as effective as

Alternative 4 since PCB contaminated landfill material will be susceptible to backflooding.

### **Reduction of Toxicity, Mobility, or Volume Through Treatment**

Alternatives 3, 4 and 5 all use incineration as treatment for the capacitors containing PCB oil. Since Alternative 5 excavates the entire landfill, more capacitors may possibly be incinerated compared to Alternative 4 or Alternative 3. The majority of the material for Alternatives 2 through 5 is PCB containing soil/material and will not undergo treatment but will be disposed of in a chemical waste landfill. Treatment is not a component of Alternative 2.

### **Short-Term Effectiveness**

Alternative 2 would result in the least short-term adverse impacts upon human health and the environment during the construction and implementation period since excavation does not take place in Alternative 2. Alternative 5 would result in the most short-term adverse impacts on human health and the environment since 320,000 cubic yards of potentially PCB contaminated material is excavated. Approximately 120,000 cubic yards of potentially PCB contaminated material will be excavated in Alternative 4 for off-site disposal or consolidation. Health and safety procedures such as air monitoring will be put in place which will minimize the risk of exposure to PCBs and other hazardous constituents.

### **Implementability**

Alternative 5 would be the most difficult to implement due to the large quantity of PCB contaminated material that must be disposed of off-site in a chemical waste landfill. The 320,000 cubic yards of potentially PCB contaminated material would require over 21,000 semi-truck loads. The large quantity of material to be moved if Alternative 5 is implemented would also force local disposal of the PCB contaminated material to be considered. Alternative 4 and Alternative 3 use a combination of off-site disposal and containment which has been used frequently at many other landfill sites. Alternative 2 would be the easiest to implement since no excavation is involved.

### **Cost**

The cost of Alternative 5 is estimated to be \$80.24 million which is approximately 5 times more expensive than the \$16.13 million required for Alternative 4. This large difference is due to the large quantities of material that are disposed of off-site in a chemical waste landfill in Alternative 5. The estimated cost for Alternatives 2, 3 and 4 are \$10.72 million, \$13.12 million and \$16.13 million respectively.

### **State Acceptance**

The State of Indiana supports Alternative 4.

Public comments have been addressed in the Responsiveness Summary.

In comparing Alternatives 2, 3, 4 and 5 to each other and against the nine criteria, the best balance among the nine criteria is Alternative 4. Alternative 5 is more protective because it removes the entire landfill but water treatment and sediment removal may still be required with this alternative. Alternative 4 removes the principal threat material equal to or greater than 500 ppm PCBs to an off-site landfill and consolidates PCB contaminated material to areas on-site which are less susceptible to backflooding. Alternative 2 and Alternative 3 leave material in locations that even with a RCRA Subtitle C compliant cap, migration of PCBs will not be reduced due to areas subjected to backflooding. Implementing Alternative 5 would be difficult due to the large quantities of material that would have to be disposed of off-site and U.S. EPA's concern of moving entire landfills to other communities. In addition, the cost of Alternative 5 is approximately 5 times more expensive than Alternative 4 and without the further evaluation of water treatment and sediment removal, Alternative 5 may still not be protective.

The following are the major ARARs for Alternative 4 for the source control operable unit at Neal's Landfill.

Surface Water Quality Standards

Surface Water Quality Criteria

Ambient Water Quality Criteria

Water Quality Standards

Storm Water Discharges

Transportation

Fugitive Dust Control

Incineration of PCBs

Chemical Waste Landfills

TSCA Spill Policy

PCB Remediation Waste

Alternative Disposal for PCBs

Waste Characterization

Hazardous waste manifests

Manifest Requirements

Management of Solid Waste

## Disposal of PCBs

### Off-site Disposal Regulations

#### Large Quantity Generator

#### Transporter requirements

#### Land Disposal Restrictions

#### Closure & Post Closure Care

#### Land Disposal Restrictions

327 IAC 15-5

33 USC 1311, 1312, 1313, 1314, 1317

40 CFR 129.105

327 IAC 2-1-6

40 CFR Parts 122.26, 33 USC 402(p)

19 CFR 171

326 IAC 6-4-2

40 CFR 761.70 & 40 CFR 264

40 CFR 761.75

40 CFR 761.120-139 - Not an ARAR but

a "to be considered"

40 CFR 761.61 - Not an ARAR but a

'to be considered"

40 CFR 761.60(e) & 329 IAC 4-1-5(7)

329 IAC 3.1 - 6.1

329 IAC 3.1 -7- 1 through 13

40 CFR 761.207, 208, 209

329 IAC 10-4-2 & 329 IAC 10-2-174

40 CFR 761.60

40 CFR 300.440

40 CFR 262

40 CFR 263 and 329 IAC 3.1-8-1 & 2

40 CFR 268.40

40 CFR 264.310(a)

40 CFR 268

The listed ARARs are associated with this source control operable unit. Other ARARs may be identified in connection with other operable units.

## VII. STATUTORY DETERMINATION

The modified remedy for the Source Control Operable Unit at Neal's Landfill includes the excavation and off-site disposal of principal threat material and consolidation and capping of material classified as a long-term, low level threat. Treatment of off-site incineration of capacitors containing PCB oil is a component of the remedy and soil/material greater than or equal to 500ppm PCBs will be disposed of in a approved chemical waste landfill. The new remedy satisfies the requirements of CERCLA 121 and a portion of the property not affected by the landfill cap may be redeveloped.

**Warning! Eat no fish from Clear Creek, Pleasant Run, Salt or Richland Creeks.**

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Files to be utilized in Preparation of the History of the Purity Oil Sales Superfund Site:

- I. Cleared Well Locations Memo
- II. Proposed Plan
- III. Beyond the Property Report
- IV. Jim's Reports
- V. Existing Chronology
- VI. New Chronology – Emails, See Below
- VII. 2001 Emails and Photographs
- VIII. 2002 Emails and Photographs
- IX. Leaching through Side Slopes
- X. Ionic Exchange with GCL and Exothermic Reactions with HDPE, refer to history
- XI. Proposed Change and Subgrade Specifications, October 2001, RFI No. 27
- XII. No. IV above led to RFI No. 28
- XIII. SECOR Submittals, refer to the below
- XIV. RFV No. 1
- XV. Geotechnical Evaluation and Conceptual Approach
- XVI. June 5, 2001 Submittal from IT and Tetra Tech's Write-up, Solidification and Stabilization Needed for the Entire Site.
- XVII.

**DTSC's Comments to the On-Site and Off-Site Remedy Evaluation  
Purity Oil Sales Superfund Site  
Fresno, California**

**I. On-Site Remedy Evaluation:**

1. The Plan suggests that eight alternatives, including the no action alternative, were evaluated against the nine CERCLA criteria. However, no reference for this alternative analysis is provided. Such analysis provides essential background for DTSC's determination of the acceptability of the preferred alternative. If no such document exists it should be developed and made part of the administrative record supporting the proposed plan.

Response: *The Basis for Amending the Record of Decision (ROD) and Description and Analysis of the Alternatives will be included in the ROD Amendment, which will be come part of the Administrative Record for the project.*

2. Remedial Action Objectives that are the basis of the remedial technologies described in the plan, i.e. neutralization, solidification, engineered fill are not identified. As a result is difficult to compare the effectiveness of each alternative. For example, solidification of some portion of the disposal area are proposed in four remedies. What is the benefit of solidification, why was it eliminated in EPA's plan?

Response: *Neutralization/solidification is the Remedial Action Objective (RAO). Benchscale testing on the low pH materials was performed to determine the most effective neutralization/solidification reagent for the low pH materials. Additional benchscale testing was performed to identify optimal treated sludge-soil mix ratios to obtain the desired moisture/density ratio for structural stability.*

*The procedures and testing mentioned above were performed to assure that the calcium carbonate mixing ratios and density/moisture relationships for the treated sludge-soil mixture met or exceeded the Data Quality Objectives (DQOs) established in the Bench scale tests, Slope Stability Analysis and Geotechnical Analysis (pH > 5, and sufficient strength to support the cap).*

*A more detail discussion regarding the above will also be included within the Proposed Plan and ROD Amendment.*

3. The basis for selection of calcium carbonate as the neutralization reagent should be discussed. Public health protection issues during implementation should be identified and discussed.

Response: *Benchscale testing of the low pH materials was performed utilizing several different reagents (Portland cement, quicklime, calcium carbonate, etc.) Field testing with quicklime was also performed. However, during the field testing, complaints were received by surrounding business/property owners regarding the odors/gas that was being produced. As a result of the review of the Benchscale testing results, as well as, complaints received by the surrounding business/property owners, EPA's Office of research and Development stated that their preferred reagent was calcium carbonate to eliminate the potential threat of sulfur dioxide gas formation during the neutralization process.*

*A more detail discussion regarding the above will also be included within the Proposed Plan and ROD Amendment.*

4. The preferred alternative identified in the plan recommends an impermeable cap. U.S. EPA should clarify if it is still recommending a RCRA cap as proposed in the original ROD. If not, a justification for this change should be included in the Plan. Any significant change to the original ROD and ESD should be fully discussed in the Proposed Plan.

Response: *EPA is not recommending a RCRA cap. The Geosynthetic components proposed by the EPA (Textured 60-mil HDPE or a GCL) both exhibit permeability's less than the underlying subsurface soils at the Purity Oil Superfund Site. Permeability of subsurface soils at Purity Oil Superfund Site is approximately  $8.74E-03$  cm/sec Permeability tests performed by the geosynthetic manufacturers (HDPE and GCL) produced permeability results of  $1.7E-9$ cm/sec and  $5.0E-10$  cm/sec, respectively. Therefore, the site will be capped as specified in 22 CCR 66264.310 for landfill closure, which requires a cap to have a permeability less than or equal to the permeability of the natural underlying soil as discussed above.*

*The cap will be designed and constructed to promote drainage, minimize erosion, and provide long term minimization of migration of liquids through the underlying soils. Long term operation and Maintenance (O&M) will be consistent with 22 CCR 66264.117.*



5. Land use covenants which will likely rely on State authority will be an essential element of this remedy. The general requirements of the LUC's should be identified in the proposed plan, e.g. no hospitals, schools residents, etc.

Response: *In order to protect the cap, deed restriction will be imposed on the site to prohibit future excavation. Once cleanup levels have been established, the site will be suitable for light industrial uses. **NEED MORE INFO.***

6. Operation and Maintenance (O&M) issues should be briefly discussed as should the O&M cost component of each alternative.

Response: *The cap will be designed and constructed to promote drainage, minimize erosion, and provide long term minimization of migration of liquids through the underlying soils. Long term operation and Maintenance (O&M) will be consistent with 22 CCR 66264.117*

*O&M issues and cost components of each alternative will be included as part of the ROD Amendment.*

7. A project schedule for implementation of the remedy should be identified.

Response: *An estimated project schedule will be included in the ROD amendment. However, implementation of neutralization of the site is estimated at taking seven (7) months. Excavation, confirmation sampling, and backfilling of the off-site properties are estimated at taking one month. The closure cover system (cap) is estimated at taking six (6) months to complete.*

*This schedule is only an estimate. The actual duration will depend upon weather (time of year) and other field variables.*

## **II. Off-site Remedy Evaluation:**

1. At a minimum, a human health risk assessment and focused feasibility Study for offsite contamination must be conducted before a final remedy is selected for off-site areas. The nature and extent of off-site contamination was not well understood or fully evaluated in previous decision documents.
2. Use of U.S. EPA industrial or residential preliminary remediation goals (PRGs) for Total Petroleum Hydrocarbons for off-site soil is inappropriate. Use of screening level techniques with PRG's does not adequately address cumulative risk at the site. Risk considerations should be based on known concentrations of

more harmful constituents, i.e. lead, volatile organic compounds (VOCs), carcinogenic polynuclear aromatic hydrocarbons (PAHs). The "Beyond the Property Line" technical memorandum suggests that high levels of TPH may have interfered with accurate analysis of other hazardous constituents.

3. Environmental or human health protective basis for proposed depth of industrial and residential excavations (four and seven feet respectively) has not been established.
4. Other off-site alternatives should be considered, e.g. removal of all contaminated soil, in situ treatment, vapor extraction and /or capping.
5. Potential for vapor migration of VOCs and SVOCs has not been adequately evaluated.
6. Potential for groundwater impact has not been adequately evaluated.

### **III. Additional DTSC Comments presented during Meetings and Conference Calls with EPA:**

On January 24, 2005, a conference call between EPA and Tetra Tech was held to discuss the comments presented by DTSC during a previous meeting with EPA and DTSC which are included as follows:

- (1) Off-site issues should be separate from on-site and is the delineation of the contaminants clear within the Proposed Plan and/or ROD Amendment?  
Actual off-site area(s) of contamination and estimate on the amount of material to be excavated.
- (2) Impact to Groundwater from soil contamination?
- (3) Non-degradation of the aquifer – some treatment to where it would not be degrading the aquifer?
- (4) Is what's left off-site (in-place) safe to stay there? And, 10 ft. bgs is the State's Requirement.
- (5) Landfill Cap not RCRA Cap
- (6) Soil Vapor data sent to Emmanuel
- (7) Proposed Plan – How did we get to the eight (8) alternatives?
- (8) Add language regarding the utilization of Calcium Carbonate instead of lime.
- (9) Beef-up RAO's and IC language. Prevent Residential use or prevent from impacting remedy.
- (10) O&M issues. Cap may be maintained for perpetuity.
- (11) How long will it take to implement Remedy?
- (12) Include lead No.'s and PRGs within the Proposed Plan.

**PURITY OIL SALES SUPERFUND SITE**  
**G00DA-193008**

**Subject:** DTSC Proposed Plan Comments – Response to Question 4

**Description:** DTSC is requesting clarification regarding the impermeable cap verses the RCRA cap. DTSC's comment is as follows: "The preferred alternative identified in the plan recommends an impermeable cap. U.S. EPA should clarify if it is still recommending a RCRA cap as proposed in the original ROD. If not, a justification for this change should be included in the Plan. Any significant change to the original ROD and ESD should be fully discussed in the Proposed Plan".

**Objective:** To justify the change from a RCRA equivalent cap, as stated in the original Record of Decision (ROD), to an impermeable cap.

**Assumptions:** 1. ROD  
Alternative 2: RCRA Equivalent Cap  
Containment Components – "the 6.8 acre site will be capped and closed as a RCRA Subtitle C landfill in accordance with the requirements specified in 22 CCR 66264.310 for landfill closure, which require a cap to have a permeability less than or equal to the permeability of the natural underlying soil".

"The cap will be designed and constructed to promote drainage, minimize erosion, and provide long term minimization of migration of liquids through the underlying soils. Consistent with the requirements of 22 CCR 66264.117, long term Operation and Maintenance (O&M) would be conducted to monitor groundwater and to insure the integrity of the cap".

2. Permeability of 60-mil Textured High Density Polyethylene (HDPE) is approximately  $1.7\text{E-}09$  ml/cm<sup>2</sup>-sec (ASTM E 96 Water Vapor Permeability).
3. Permeability of Geosynthetic Clay Liner (GCL) is approximately  $5.0\text{E-}10$  cm/sec (ASTM D 5084 or E 96).
4. Permeability of subsurface soils at Purity Oil Superfund Site is approximately  $8.74\text{E-}03$  cm/sec (see attached calculations).

**Conclusion:** The Geosynthetic components proposed by the EPA (Textured 60-mil HDPE or a GCL) both exhibit permeability's less than the underlying subsurface soils at the Purity Oil Superfund Site. Permeability tests performed by the geosynthetic manufacturers (HDPE and GCL) produced permeability results of  $1.7\text{E-}9$ cm/sec and  $5.0\text{E-}10$  cm/sec, respectively.

Therefore, the site will be capped as specified in 22 CCR 66264.310 for landfill closure, which requires a cap to have a permeability less than or equal to the permeability of the natural underlying soil.

The cap will be designed and constructed to promote drainage, minimize erosion, and provide long term minimization of migration of liquids through the underlying soils. Long term Operation and Maintenance (O&M) will be consistent with 22 CCR 66264.117.

**PURITY OIL SALES UPERFUND SITE**  
**G00DA-193008**

**Subject:** DTSC Propose Plan Comments – Response to Question 4  
Supporting Calculations

**Objective:** To determine the Hydraulic Conductivity of the subsurface soils at the Purity Oil Superfund Site.

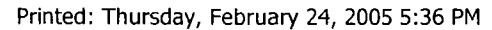
**Assumptions:**

1. Permeability (intrinsic permeability) of the subsurface soils at the Purity Oil Superfund Site is approximately  $8.958\text{E-}08 \text{ cm}^2$  (Final 100% Design Report, Purity Oil Sales, Operable Unit Two (OU-2), Volume I, Appendix D, Soil Vapor Extraction System Design Calculations, June 1996)
2. Effective Soil Porosity utilized in the 100% Design for the subsurface soils = 0.383.
3. Sands typically exhibit hydraulic conductivities in the  $10^{-01} \text{ cm/sec} - 10^{-03} \text{ cm/sec}$  range, Silt typically exhibit hydraulic conductivities (k) in the  $10^{-04} \text{ cm/sec} - 10^{-06} \text{ cm/sec}$  range, (Practical Design Calculations for Groundwater and Soil Remediation, Jeff Kuo PhD, PE, 1999).
4. Viscosity of Water at  $20^\circ \text{ C} = 1.002 \text{ centipoise}$
5. Viscosity of Water at  $25^\circ \text{ C} = 0.890 \text{ centipoise}$
6. Density of Water at  $20^\circ \text{ C} = 0.998207 \text{ g/cm}^3$
7. Viscosity of Air = 0.018 centipoise
8. 1 Centipoise = 0.01 gram/cm-sec
9. Gravitational Constant =  $980 \text{ cm/sec}^2$
10. K = Hydraulic Conductivity
11. k = Intrinsic permeability =  $8.958\text{E-}08 \text{ cm}^2$
12. u = Fluid Viscosity = 0.01002g/cm-sec
13. p = Fluid Density =  $0.998207 \text{ g/cm}^3$
14. g =Gravitational Constant =  $980 \text{ cm/sec}^2$
15. Formula =  $K = \frac{kpg}{u}$

Calculations:  $K = \frac{kpg}{u}$

$$K = \frac{8.958E-08 \text{ cm}^2 \times 0.998207 \text{ g/cm}^3 \times 980 \text{ cm/sec}^2}{0.01002 \text{ g/cm-sec}}$$

$$K = 8.74E-03 \text{ cm/sec}$$



 Attachment : hydraulicconductivity.pdf (0.63 MB)

Mark

# PRACTICAL DESIGN CALCULATIONS

for Groundwater and Soil Remediation

JEFF KUO, PH.D., P.E.

Civil and Environmental Engineering  
California State University, Fullerton



**LEWIS PUBLISHERS**

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## About the author

Jeff (Jih-Fen) Kuo worked in environmental engineering industries for over 10 years before joining the Department of Civil and Environmental Engineering at California State University, Fullerton, in 1995. He gained his industrial experiences from working at Groundwater Technology, Inc. (now Flour-GTI), Dames and Moore, James M. Montgomery Consulting Engineers (now Montgomery-Watson), Nan-Ya Plastics, and the Los Angeles County Sanitation Districts. His industrial experiences in environmental engineering include design and installation of air strippers, activated carbon adsorbers, flare/catalytic incinerators, and biological systems for groundwater and soil remediation; site assessment and fate analysis of toxics in the environment; RI/FS work for landfills and Superfund sites; design of flanged joints to meet stringent fugitive emission requirements; air emissions from wastewater treatment; and wastewater treatment. Areas of research in environmental engineering include dechlorination of halogenated aromatics by ultrasound, fines/bacteria migration through porous media, biodegradability of bitumen, surface properties of composite mineral oxides, kinetics of activated carbon adsorption, wastewater filtration, THM formation potential of ion exchange resins, and UV disinfection.

He received a B.S. degree in chemical engineering from National Taiwan University, an M.S. degree in chemical engineering from the University of Wyoming, an M.S. in petroleum engineering, and an M.S. and a Ph.D. in Environmental Engineering from the University of Southern California. He is a professional civil, mechanical, and chemical engineer registered in California.

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### *chapter three*

## *Plume migration in groundwater and soil*

In Chapter two we illustrated the necessary calculations for site characterization and remedial investigation. Generally, from the RI activities the extent of the plume in the vadose zone and/or groundwater is defined. If the contaminants cannot be removed immediately, they will migrate under common field conditions and the extent of the plume will enlarge.

In the vadose zone, the contaminants will move downward as a free product or become dissolved in infiltrating water and then move downward by gravity. The downward-moving liquid may come in contact with the underlying aquifer and create a dissolved plume. In addition, the VOCs will volatilize into the air void of the vadose zone and travel under advective forces (with the air flow) or concentration gradients (through diffusion). Migration of the vapor can be in any direction, and the contaminants in the vapor phase, when coming in contact with the groundwater, may also dissolve into the groundwater. For site remediation or health risk assessment, understanding the fate and transport of contaminants in the subsurface is important. Common questions related to the fate and transport of contaminants in the subsurface include

1. How long will it take for the plume in the vadose zone to enter the aquifer?
2. How far will the vapor contaminants in the vadose zone travel? In what concentrations?
3. How fast does the groundwater flow? In which direction?
4. How fast will the plume migrate? In which direction?
5. Will the plume migrate at the same speed as the groundwater flow or at a different speed? If different, what are the factors that would

make the plume migrate at a different speed from the groundwater flow?

6. How long has the plume been present in the aquifer?

This chapter illustrates the basic calculations needed to answer most of the above questions. The first section presents the calculations for groundwater movement and clarifies some common misconceptions about groundwater velocity and hydraulic conductivity. Procedures to determine the groundwater flow gradient and the flow direction are also given. The second section presents groundwater extraction from confined and unconfined aquifers. Since hydraulic conductivity plays a pivotal role in groundwater movement, several common methodologies of estimating this parameter are covered, including the aquifer tests. The discussion then moves to the migration of the dissolved plume in the aquifer and in the vadose zone.

### III.1 Groundwater movement

#### III.1.1 Darcy's law

Darcy's Law is commonly used to describe laminar flow in porous media. For a given medium the flow rate is proportional to the head loss and inversely proportional to the length of flow path. Flow in typical groundwater aquifers is laminar, and therefore Darcy's Law is valid. Darcy's Law can be expressed as

$$v = \frac{Q}{A} = -K \frac{dh}{dl} \quad [\text{Eq. III.1.1}]$$

where  $v$  is the Darcy velocity,  $Q$  is the volumetric flow rate,  $A$  is the cross-sectional area of the porous medium perpendicular to the flow,  $dh/dl$  is the hydraulic gradient (a dimensionless quantity), and  $K$  is the hydraulic conductivity.

The hydraulic conductivity tells how permeable the porous medium is to the flowing fluid. The larger the  $K$  of a formation, the easier the fluid flows through it.

Commonly used units for hydraulic conductivity are either in velocity units such as ft/d, cm/s, or m/d, or in volumetric flow rate per unit area such as gpd/ft<sup>2</sup>. You may find the unit conversions in Table III.1.A helpful.

#### Example III.1.1 Estimate the rate of fresh groundwater in contact with the plume

Leachates from a landfill leaked into the underlying aquifer and created a contaminated plume. Use the information below to estimate the amount of fresh groundwater that enters into the contaminated zone per day.

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## Chapter three: Plume migration in groundwater and soil

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The maximum cross-sectional area of the plume perpendicular to the groundwater flow = 1600 ft<sup>2</sup>  
 Groundwater gradient = 0.005  
 Hydraulic conductivity = 2500 gpd/ft<sup>2</sup>

*Solution:*

Another common form of Darcy's Law (Eq. III.1.1) is

$$Q = KiA \quad [\text{Eq. III.1.2}]$$

where  $i$  is the hydraulic gradient,  $dh/dl$ .

The rate of fresh groundwater entering the plume can be found by inserting the appropriate values into the above equation:

$$Q = (2500 \text{ gpd/ft}^2)(0.005)(1600 \text{ ft}^2) = 20,000 \text{ gpd}$$

*Discussion*

1. The calculation itself is straightforward and simple. However, we can get valuable and useful information from this exercise. The rate of 20,000 gal/day represents the rate of uncontaminated groundwater that will come in contact with the contaminants. This water would become contaminated and move downstream or sidestream and, consequently, enlarge the size of the plume. To control the spread of the plume, we have to extract this amount of water, 20,000 gpd or ~14 gpm, as a minimum. The actual extraction rate required should be higher than this because the groundwater drawdown from pumping will increase the flow gradient. This increased gradient will, in turn, increase the rate of groundwater entering the plume zone as indicated by the equation above.
2. Using the maximum cross-sectional area is a legitimate approach that represents the "contact face" between the fresh groundwater and the plume.

## III.1.2 Darcy's velocity vs. seepage velocity

The velocity term in Eq. III.1.1 is called the Darcy velocity (or the discharge velocity). Does this Darcy velocity represent the groundwater flow velocity?

Table III.1.A Common Conversion Factors  
for Hydraulic Conductivity

m/d	cm/s	ft/d	gpd/ft <sup>2</sup>
1	1.16E - 3	3.28	2.45E + 1
8.64E + 2	1	2.83E + 3	2.12E + 4
3.05E - 1	3.53E - 4	1	7.48
4.1E - 2	4.73E - 5	1.34E - 1	1

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The answer is "no." The Darcy velocity in that equation assumes the flow occurs through the entire cross-section of the porous medium. In other words, it is the velocity at which water would move through an aquifer if the aquifer were an open conduit. Actually, the flow is limited to the available pore space only (the effective cross-sectional area available for flow is smaller), so the actual fluid velocity through the porous medium would be larger than the Darcy velocity. This flow velocity is often called the seepage velocity or the interstitial velocity. The relationship between the seepage velocity,  $v_s$ , and the Darcy velocity,  $v$ , is as follows:

$$v_s = \frac{Q}{\phi A} = \frac{v}{\phi} \quad [\text{Eq. III.1.3}]$$

where  $\phi$  is the porosity. For example, for an aquifer with a porosity of 33%, the seepage velocity of groundwater flowing through this aquifer will be three times the Darcy velocity (i.e.,  $v_s = 3 v$ ).

#### Example III.1.2 Determine Darcy velocity and seepage velocity

There is spill of an inert (or a conservative) substance into the subsurface. The spill infiltrates the unsaturated zone and quickly reaches the underlying water table aquifer. The aquifer consists mainly of sand and gravel with a hydraulic conductivity of 2500 gpd/ft<sup>2</sup> and an effective porosity of 0.35. The water level in a well neighboring the spill lies at an altitude of 560 ft, and the level in another well 1 mile directly down gradient is 550 ft. Determine

- The Darcy velocity of the groundwater
- The seepage velocity of the groundwater
- The velocity of plume migration
- How long it will take for the plume to reach the down-gradient well

#### Solution:

- We have to determine the gradient of the aquifer first

$$i = dh/dl = (560 - 550)/5280 = 1.89 \times 10^{-3} \text{ ft/ft}$$

Darcy velocity =  $Ki$

$$\left[ (2500 \text{ gpd/ft}^2) \left( 0.134 \frac{\text{ft/d}}{\text{gpd/ft}^2} \right) \right] (1.89 \times 10^{-3} \text{ ft/ft}) = 0.63 \text{ ft/d}$$

- Seepage velocity =  $v/\phi$

$$0.63/0.35 = 1.81 \text{ ft/d}$$

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## Chapter three: Plume migration in groundwater and soil

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- c. The pollutant is inert, meaning that it will not react with the aquifer. (Sodium chloride is a good example of an inert substance and is often used as a tracer in an aquifer study.) Therefore, the velocity of plume migration for this case is the same as the seepage velocity, 1.81 ft/d.
- d. Time = distance/velocity

$$5280 \text{ ft} / (1.81 \text{ ft/d}) = 2912 \text{ days} = 8.0 \text{ year}$$

## Discussion

1. The conversion factor,  $1 \text{ gpd/ft}^2 = 0.134 \text{ ft/d}$ , used in (a) is from Table III.1.A.
2. The calculated plume migration velocity is crude at best and should only be considered as a rough estimate. Many factors, such as hydrodynamic dispersion, are not considered in this equation. The dispersion can cause parcels of water to spread transversely to the major direction of groundwater flow and move longitudinally, down gradient, at a faster rate. The dispersion is caused by an intermixing of water particles due to the differences in interstitial velocity induced by the heterogeneous pore sizes and tortuosity.
3. In addition, the migration of most chemicals will be retarded by interactions with the geologic formation, especially with clays, soil-organic matter, and metal oxides and hydroxides. This phenomenon will be discussed further in Section III.4.3.

## III.1.3 Intrinsic permeability vs. hydraulic conductivity

In the soil venting literature one may encounter a statement such as "the soil permeability is 4 Darcies," while in groundwater remediation literature one may read that "the hydraulic conductivity is equal to 3 cm/s." Both statements describe how permeable the formations are. Are they the same? If not, what is the relationship between the permeability and hydraulic conductivity?

These two terms, permeability and hydraulic conductivity, are sometimes used interchangeably. However, they do have different meanings. The intrinsic permeability of a porous medium (i.e., a rock or soil) defines its ability to transmit a fluid. It is a property of the medium only and is independent of the properties of the transmitting fluid. That is why it is called the "intrinsic" permeability. On the other hand, the hydraulic conductivity of a porous medium depends on the properties of the fluid flowing through it.

Hydraulic conductivity is conveniently used to describe the ability of an aquifer to transmit groundwater. A porous medium has a unit hydraulic conductivity if it will transmit a unit volume of groundwater through a unit cross-sectional area (perpendicular to the direction of flow) in a unit time at the prevailing kinematic viscosity and under a unit hydraulic gradient.

The relationship between the intrinsic permeability and hydraulic conductivity is

$$K = \frac{k\rho g}{\mu} \text{ or } k = \frac{K\mu}{\rho g} \quad [\text{Eq. III.1.4}]$$

where  $K$  is the hydraulic conductivity,  $k$  is the intrinsic permeability,  $\mu$  is the fluid viscosity,  $\rho$  is the fluid density, and  $g$  is the gravitational constant (kinematic viscosity =  $\mu/\rho$ ). The intrinsic permeability has a unit of area as shown below:

$$k = \frac{K\mu}{\rho g} = \frac{(\text{m/s})(\text{kg/m} \cdot \text{s})}{(\text{kg/m}^3)(\text{m/s}^2)} = [\text{m}^2] \quad [\text{Eq. III.1.5}]$$

In petroleum industries the intrinsic permeability of a formation is measured by a unit termed Darcy. A formation has an intrinsic permeability of 1 Darcy if it can transmit a flow of 1 cm<sup>3</sup>/s with a viscosity of 1 centipoise under a pressure gradient of 1 atmosphere/cm, that is,

$$1 \text{ Darcy} = \frac{(1 \text{ g/cm} \cdot \text{s})(1 \text{ cm}^3/\text{s})}{1 \text{ cm}^2 \cdot 1 \text{ atmosphere/cm}} \quad [\text{Eq. III.1.6}]$$

By substitution of appropriate units, it can be shown that

$$1 \text{ Darcy} = 0.987 \times 10^{-8} \text{ cm}^2 \quad [\text{Eq. III.1.7}]$$

Table III.1.B lists the mass density and viscosity of water under one atmosphere. As shown in the table, the density of water from 0 to 30°C is essentially the same, at 1 g/cm<sup>3</sup>; the viscosity of water decreases with increasing temperature. The viscosity of water at 20°C is one centipoise. (This is the viscosity value of the fluid used in defining the Darcy unit.)

**Example III.1.3** Determine hydraulic conductivity from a given intrinsic permeability

The intrinsic permeability of a soil core sample is 1 Darcy. What is the hydraulic conductivity of this soil for water at 15°C? How about at 25°C?

**Solution:**

- a. At 15°C, density of water (15°C) = 0.999703 g/cm<sup>3</sup> (from Table III.1.B), and viscosity of water (15°C) = 0.01139 poise = 0.01139 g/s · cm (from Table III.1.B).

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## Chapter three: Plume migration in groundwater and soil

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$$K = \frac{kpg}{\mu} = \frac{(9.87 \times 10^{-9} \text{ cm}^2)(0.999703 \text{ g/cm}^3)(980 \text{ cm/s}^2)}{0.01139 \text{ g/s} \cdot \text{cm}}$$

$$= 8.49 \times 10^{-4} \text{ cm/s}$$

$$= (8.49 \times 10^{-4})(2.12 \times 10^4) = 18.0 \text{ gpd/ft}^2 = 18.0 \text{ meinzers}$$

b. At 25°C, density of water (25°C) = 0.997048 g/cm<sup>3</sup> (from Table III.1.B), and viscosity of water (25°C) = 0.00890 poise = 0.00890 g/s · cm (from Table III.1.B).

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$$K = \frac{kpg}{\mu} = \frac{(9.87 \times 10^{-9} \text{ cm}^2)(0.999703 \text{ g/cm}^3)(980 \text{ cm/s}^2)}{0.00890 \text{ g/s} \cdot \text{cm}}$$

$$= 1.09 \times 10^{-3} \text{ cm/s}$$

$$= (1.09 \times 10^{-3})(2.12 \times 10^4) = 23.0 \text{ gpd/ft}^2$$

III.1.6]

**Discussion.** This example illustrates that a porous medium with an intrinsic permeability of 1 Darcy has a hydraulic conductivity of 18 gpd/ft<sup>2</sup> at 15°C (23 gpd/ft<sup>2</sup> at 25°C). The unit of gpd/ft<sup>2</sup> is commonly used by hydrogeologists in the United States. The unit is also named the meizner after O. E. Meinzer, a pioneering groundwater hydrogeologist with U.S. Geological Services.<sup>2</sup> The unit of cm/s is more commonly used in soil mechanics. (For example, the hydraulic conductivity of clay liners or flexible membrane liners in landfills is commonly expressed in cm/s.)

From the above example, one can tell that a geologic formation with an intrinsic permeability of one Darcy has a hydraulic conductivity of approximately 10<sup>-3</sup> cm/s or 20 gpd/ft<sup>2</sup> for transmitting pure water at 20°C. Typical

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Table III.1.B Physical Properties of Water under  
One Atmosphere

Temperature (°C)	Density (g/cm <sup>3</sup> )	Viscosity (cp)
0	0.999842	1.787
3.98	1.000000	1.567
5	0.999967	1.519
10	0.999703	1.307
15	0.999103	1.139
20	0.998207	1.002
25	0.997048	0.890
30	0.995650	0.798
40	0.992219	0.653

Note: 1 g/cm<sup>3</sup> = 1000 kg/m<sup>3</sup> = 62.4 lb/ft<sup>3</sup>. 1 centipoise = 0.01 poise = 0.01 g/cm · s = 0.001 Pa · s = 2.1 × 10<sup>-6</sup> lb · s/ft<sup>2</sup>.

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Table III.1.C Typical Values of Intrinsic Permeabilities and Hydraulic Conductivities

	Intrinsic permeability (Darcy)	Hydraulic conductivity (cm/s)	Hydraulic conductivity (gpd/ft <sup>2</sup> )
Clay	$10^{-6}$ – $10^{-3}$	$10^{-9}$ – $10^{-4}$	$10^{-2}$ – $10^{-2}$
Silt	$10^{-3}$ – $10^{-1}$	$10^{-6}$ – $10^{-4}$	$10^{-2}$ –1
Silty sands	$10^{-2}$ –1	$10^{-5}$ – $10^{-3}$	$10^{-1}$ –10
Sands	1– $10^2$	$10^{-3}$ – $10^{-1}$	10– $10^3$
Gravel	$10$ – $10^3$	$10^{-2}$ –1	$10^2$ – $10^4$

values of intrinsic permeabilities and hydraulic conductivities for different types of formations are given in Table III.1.C.

#### III.1.4 Transmissivity, specific yield, and storativity

Transmissivity ( $T$ ) is another concept that is commonly used to describe an aquifer's capacity to transmit water. It represents the amount of water that can be transmitted horizontally by the entire saturated thickness of the aquifer under a hydraulic gradient of one. It is equal to the multiplication product of the aquifer thickness ( $b$ ) and the hydraulic conductivity ( $K$ ). Commonly used units for  $T$  are m<sup>2</sup>/d and gpd/ft.

$$T = Kb$$

[Eq. III.1.8]

An aquifer typically serves two functions: (1) a conduit through which flow occurs and (2) a storage reservoir. This is accomplished by the openings in the aquifer matrix. If a unit of saturated formation is allowed to drain by gravity, not all of the water it contains will be released. The ratio of water that can be drained by gravity to the entire volume of a saturated soil is called specific yield, while the part retained is the specific retention. Table III.1.D lists typical porosity, specific yield, and specific retention of soil, clay, sand, and gravel. The sum of the specific yield and the specific retention of a formation is equal to its porosity.

The specific yield and the specific retention are related to the attraction between water and the formation materials. Clayey formations usually have a lower hydraulic conductivity. This often leads to an incorrect idea that clayey formations have a lower porosity. As shown in Table III.1.D, clay has a much higher porosity than sand, and sand has a higher porosity than gravel. The porosity of clay can be as high as 50%, but its specific yield is extremely low at 2%. Porosity determines the total volume of water that a formation can store, while specific yield defines the amount that is available to pumping. The low specific yield explains the difficulty of extracting groundwater from clayey aquifers.

When the head in a saturated aquifer changes, water will be taken into or released from storage. Storativity or storage coefficient ( $S$ ) describes the

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Table III.1.D Typical Porosity, Specific Yield, and Specific Retention of Selected Materials

	Porosity (%)	Specific yield (%)	Specific retention (%)
Soil	55	40	15
Clay	50	2	48
Sands	25	22	3
Gravel	20	19	1

From U.S. EPA, *Ground Water Volume I: Ground Water and Contamination*, EPA/625/6-90/016a, U.S. EPA, Washington, DC, 1990.

quantity of water taken into or released from storage per unit change in head per unit area. It is a dimensionless quantity. The response of a confined aquifer to the change of water head is different from that of an unconfined aquifer. When the head declines, a confined aquifer remains saturated; the water is released from storage by the expansion of water and compaction of aquifer. The amount of release is exceedingly small. On the other hand, the water table rises or falls with change of head in an unconfined aquifer. As the water level changes, water drains from or enters into the pore spaces. This storage or release is mainly due to the specific yield. It is also a dimensionless quantity. For unconfined aquifers the storativity is practically equal to the specific yield and ranges typically between 0.1 and 0.3. The storativity of confined aquifers is substantially smaller and generally ranges between 0.0001 and 0.0001, and that for leaky confined aquifers is in the range of 0.001. A small storativity implies that it will require a larger pressure change (or gradient) to extract groundwater at a specific flow rate.<sup>7</sup>

The volume of groundwater ( $V$ ) drained from an aquifer can be determined from the following:

$$V = SA(\Delta h) \quad [\text{Eq. III.1.9}]$$

where  $S$  is the storativity,  $A$  is the area of the aquifer, and  $\Delta h$  is the change in head.

**Example III.1.4** Estimate loss of storage in aquifers due to change of head

An unconfined aquifer has an area of 5 square miles. The storativity of this aquifer is 0.15. The water table falls 0.8 feet during a drought. Estimate the amount of water lost from storage.

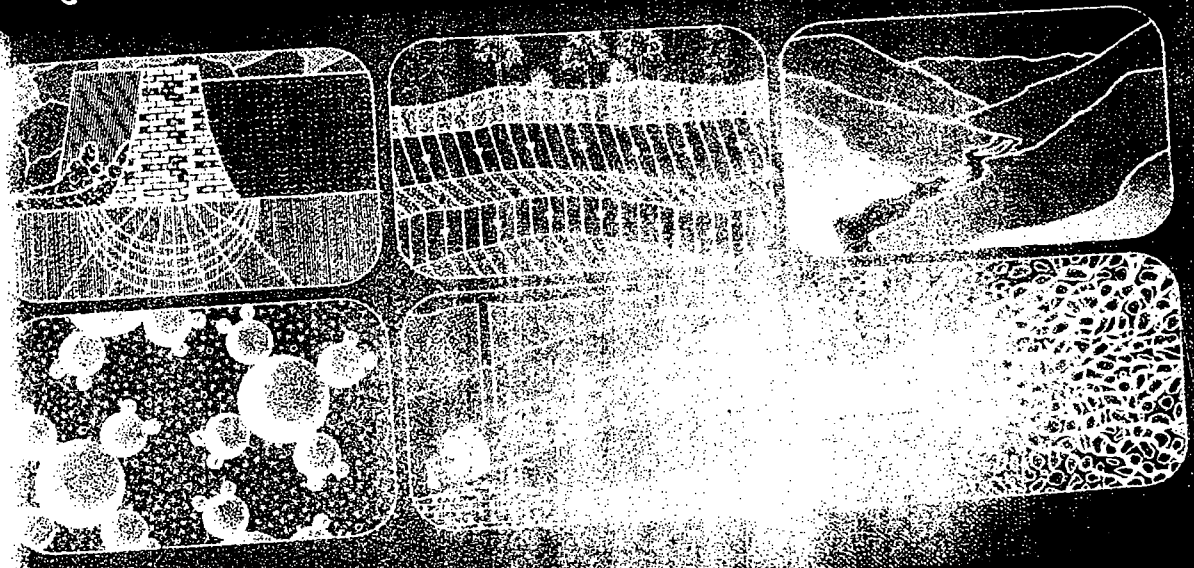
If the aquifer is confined and its storativity is 0.0005, what would be the amount lost for a decrease of 0.8 feet in head?

Text

# GROUNDWATER

# GROUNDWATER

R. Allan Freeze / John A. Cherry



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oil, and water in multiphase flow systems makes the use of a fluid-free conductance parameter attractive. When measured in  $m^2$  or  $cm^2$ ,  $k$  is very small, so petroleum engineers have defined the darcy as a unit of permeability. If Eq. (2.28) is substituted in Eq. (2.3), Darcy's law becomes

$$v = \frac{-k \rho g}{\mu} \frac{dh}{dl} \quad (2.29)$$

Referring to this equation, 1 darcy is defined as the permeability that will lead to a specific discharge of 1 cm/s for a fluid with a viscosity of 1 cp under a hydraulic gradient that makes the term  $\rho g dh/dl$  equal to 1 atm/cm. One darcy is approximately equal to  $10^{-8} cm^2$ .

In the water well industry, the unit gal/day/ft<sup>2</sup> is widely used for hydraulic conductivity. Its relevance is clearest when Darcy's law is couched in terms of Eq. (2.4):

$$Q = -K \frac{dh}{dl} A$$

The early definitions provided by the U.S. Geological Survey with regard to this unit differentiate between a laboratory coefficient and a field coefficient. However, a recent updating of these definitions (Lohman, 1972) has discarded this formal differentiation. It is sufficient to note that differences in the temperature of measurement between the field environment and the laboratory environment can influence hydraulic conductivity values through the viscosity term in Eq. (2.28). The effect is usually small, so correction factors are seldom introduced. It still makes good sense to report whether hydraulic conductivity measurements have been carried out in the laboratory or in the field, because the methods of measurement are very different and the interpretations placed on the values may be dependent on the type of measurement. However, this information is of practical rather than conceptual importance.

Table 2.2 indicates the range of values of hydraulic conductivity and permeability in five different systems of units for a wide range of geological materials. The table is based in part on the data summarized in Davis' (1969) review. The primary conclusion that can be drawn from the data is that hydraulic conductivity varies over a very wide range. There are very few physical parameters that take on values over 13 orders of magnitude. In practical terms, this property implies that an order-of-magnitude knowledge of hydraulic conductivity can be very useful. Conversely, the third decimal place in a reported conductivity value probably has little significance.

Table 2.3 provides a set of conversion factors for the various common units of  $k$  and  $K$ . As an example of its use, note that a  $k$  value in  $cm^2$  can be converted to one in  $ft^2$  by multiplying by  $1.08 \times 10^{-3}$ . For the reverse conversion from  $ft^2$  to  $cm^2$ , multiply by  $9.29 \times 10^2$ .

— Karst limestone —  
— Permeable basalt —  
— Fractured igneous and metamorphic rocks —

$cm^2$	
$ft^2$	9.29
darcy	9.8
m/s	1.0
ft/s	3.1
U.S. gal/day/ft <sup>2</sup>	5.4

\*To obtain  $k$

Table 2.2 Range of Values of Hydraulic Conductivity and Permeability

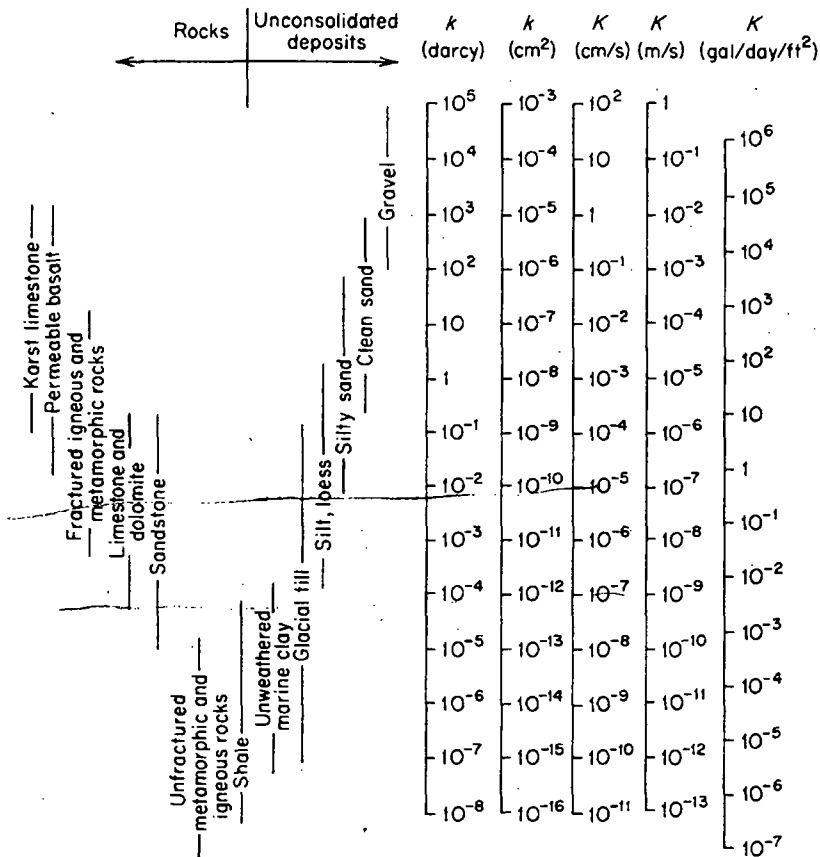
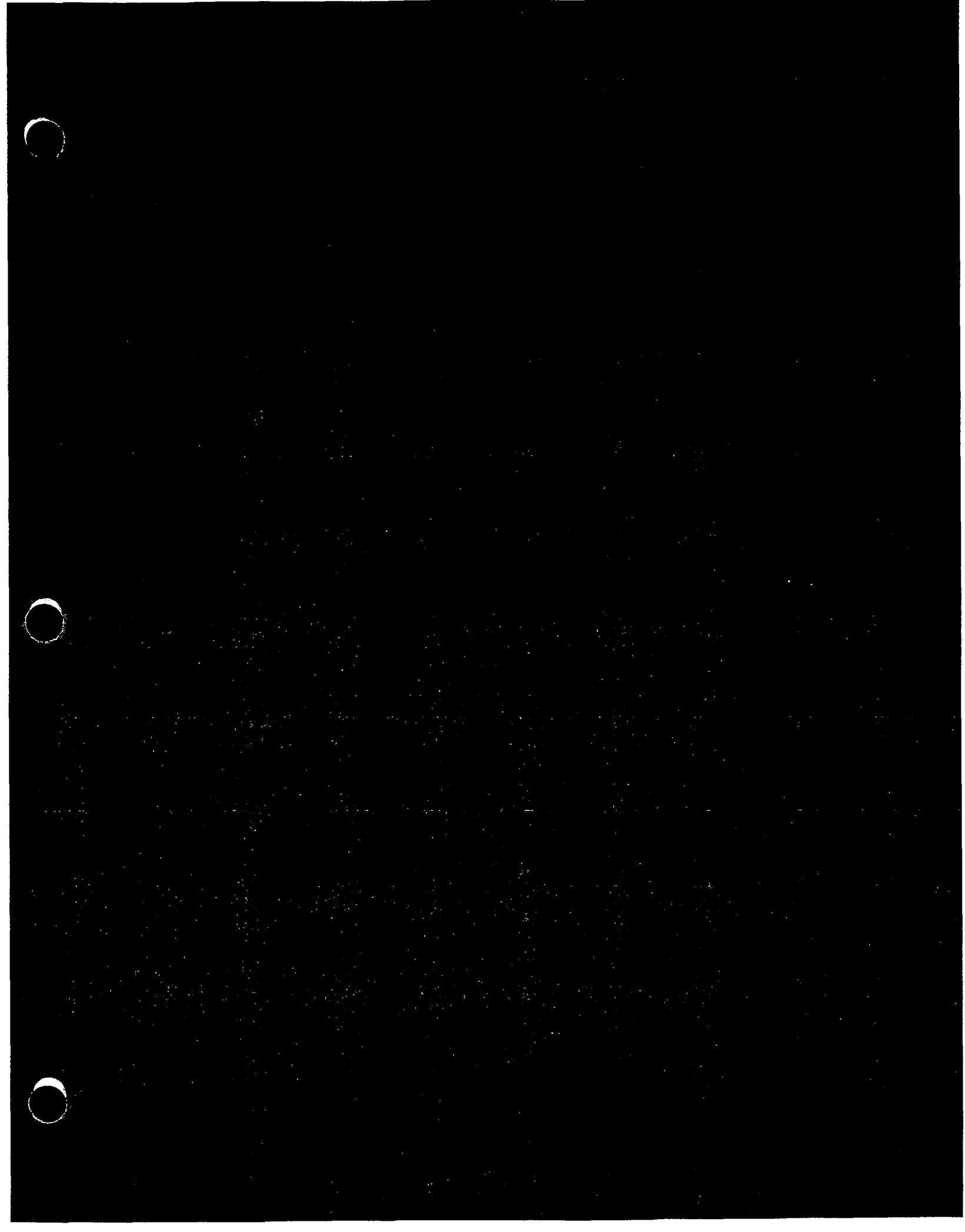


Table 2.3 Conversion Factors for Permeability and Hydraulic Conductivity Units

	Permeability, $k^*$			Hydraulic conductivity, $K$		
	cm <sup>2</sup>	ft <sup>2</sup>	darcy	m/s	ft/s	U.S. gal/day/ft <sup>2</sup>
cm <sup>2</sup>	1	$1.08 \times 10^{-3}$	$1.01 \times 10^8$	$9.80 \times 10^{-1}$	$3.22 \times 10^3$	$1.85 \times 10^9$
ft <sup>2</sup>	$9.29 \times 10^2$	1	$9.42 \times 10^{10}$	$9.14 \times 10^{-1}$	$2.99 \times 10^6$	$1.71 \times 10^{12}$
darcy	$9.87 \times 10^{-9}$	$1.06 \times 10^{-11}$	1	$9.66 \times 10^{-6}$	$3.17 \times 10^{-5}$	$1.82 \times 10^1$
m/s	$1.02 \times 10^{-3}$	$1.10 \times 10^{-6}$	$1.04 \times 10^5$	1	3.28	$2.12 \times 10^6$
ft/s	$3.11 \times 10^{-4}$	$3.35 \times 10^{-7}$	$3.15 \times 10^4$	$3.05 \times 10^{-1}$	1	$6.46 \times 10^5$
U.S. gal/day/ft <sup>2</sup>	$5.42 \times 10^{-10}$	$5.83 \times 10^{-13}$	$5.49 \times 10^{-2}$	$4.72 \times 10^{-7}$	$1.55 \times 10^{-6}$	1

\*To obtain  $k$  in ft<sup>2</sup>, multiply  $k$  in cm<sup>2</sup> by  $1.08 \times 10^{-3}$ .



## **Basis for Amending the ROD (History)**

Remedial activities for implementing the Operable Unit 02 ROD were initiated in October 2000. During these remedial activities, low pH materials (acidic liquid, sludge, tar) and large quantities of deleterious material were observed within the site and on the perimeter slopes. Due to the above, EPA began to question the effectiveness of the original remedy and began to assess other possible remedial alternatives (Refer to Section ??? for a detailed analysis and description of the alternatives).

As part of this assessment, numerous meetings were held with the PRP's and their subcontractors to determine the following:

1. If the original design assumptions were correct due to the presence of the low pH materials;
2. If low pH materials or contaminants migrated off-site (Refer to the Technical Memorandum, Beyond the Property Line Investigation Report, April 2003 included in the Administrative Record);
3. If the low pH materials would effect the geosynthetic components of the cap; and,
4. If the remedy could be implemented in accordance with the Final (100%) Design Report (A copy of this Report is included in Administrative Record).

As a result of these meetings, the EPA requested that the PRP and its' subcontractor; (1) assess the stability of the site and its' perimeter slopes, (2) excavate a perimeter trench to ensure that low pH materials or other contaminants had not migrated off-site, (3) perform bench scale tests on the low pH materials (acidic liquid, sludge, and tar), and (4) implement the remedy as specified in the Final (100%) design.

While assessing the implementation of the remedy, the low pH and deleterious materials prohibited compaction testing of the waste layer, leached to the surface after being covered with soil and geosynthetic fabrics, reacted violently when treated with quicklime®, and based upon the geosynthetic manufacturer's recommendation, the low pH materials would react negatively with the geosynthetic components of the cap, thereby, reducing its permeability and lifespan.

Therefore, due to these difficulties, the EPA and PRP's began to evaluate 8 remedial alternatives that would address the low pH materials and meet the nine evaluation criteria (Refer to Section ??? for a detailed analysis and description of the alternatives).

In April and July 2002, Bench Scale Testing was performed to evaluate the most effective neutralization and solidification reagent for the low pH material. Quicklime®, Portland cement and calcium carbonate were the three (3) reagents utilized during these Bench scale tests. However, calcium carbonate was EPA's preferred neutralization reagent since it would eliminate the potential threat of the sulfur dioxide gas formation during the neutralization process.



Additional Bench scale testing was then performed to identify calcium carbonate mixing ratios and density/moisture relationships for the treated sludge-soil mixture to optimize neutralization and solidification activities in the field.

Between April and June 2003, a neutralization pilot test was conducted to identify and define procedures that would be most effective in the field by utilizing the results of the Bench scale tests performed by the PRP's subcontractor and to evaluate and determine the most effective neutralization procedures for the low pH material. The procedures during this neutralization pilot test included the following:

1. Excavating and segregating the sludge from the soil,
2. Neutralization activities by ex-situ mixing of the sludge with calcium carbonate and soil (due to the heterogeneity of the sludge materials at the site, field titrations were conducted),
3. Field pH testing of the neutralized material and field density testing for the compacted neutralized materials; and,
4. Perimeter and Real-time Air Monitoring and Sampling.

The procedures and testing mentioned above were performed to assure that the calcium carbonate mixing ratios and density/moisture relationships for the treated sludge-soil mixture met or exceeded the Data Quality Objectives (DQOs) established in the Bench scale tests, Slope Stability Analysis and Geotechnical Analysis (pH > 5, and sufficient strength to support the cap).

???Based on the pilot test results and by evaluating the 8 remedial alternatives and determining which alternative(s) would meet the nine criteria, Alternative ??? was selected.

## **Description and Analysis of Alternatives**

### **Sludge Remedy Alternative 1 – No Action:**

Under this alternative the liquid/tar/sludge within the site would not be addressed. The original remedy would be implemented as defined in the original Record of Decision (ROD).

### **Sludge Remedy Alternative 2 – Solidify Upper 2 Feet on Perimeter Slope of Waste Pits:**

This alternative would involve excavating the upper 2-feet of soil along the entire perimeter area of the waste pits, e.g. perimeter slopes, solidify/treat the excavated soil with Portland cement, and placing the material back in the excavation and compacting the treated soil. The site would then be capped with a RCRA cap.

Approximately 6,000 cubic yards of liquid/tar/sludge impacted soils would be; (1) excavated, (2) treated/solidified ex-situ with approximately 800 tons of Portland cement (10% by weight), and (3) placed back into the excavated area and compacted. The Portland cement will act as a binding agent that will increase the compressive strength of the treated material, decrease its permeability, and increase the pH to create a 2 foot buffer zone between the remaining untreated soil within the site and the RCRA cap.

The cap would consist of a 2 foot foundation layer, a geosynthetic clay liner (GCL), a 60-mil high density polyethylene liner (HDPE), and a 1 foot vegetative layer. The cap would be designed and constructed to promote drainage, minimize erosion, and provide long term minimization of migration of liquids through the cap. Long term operation and maintenance (O&M) would insure the integrity of the cap.

### **Sludge Remedy Alternative 3 – Neutralize and Solidify Perimeter Waste Pits:**

This alternative would involve excavating soil along the perimeter of the former waste pits outer wedge to 10 feet inside the crest and to a depth of 13 feet. The site would then be capped with a RCRA cap, see alternative 2 for description of RCRA cap.

Bench scale testing was conducted on the liquid/tar/sludge impacted soils to determine optimal calcium carbonate addition rates for pH adjustment of the acidic liquid/tar/sludge at the site. The objective was to increase the pH above 5 for the neutralized material while eliminating the potential for sulfur dioxide gas to form during the treatment process. The Portland cement will act as a binding agent that will increase the compressive strength of the treated material, decrease its permeability, and create a buffer zone between the remaining untreated soils within the site and the RCRA cap.

Approximately 25,000 cubic yards of liquid/tar/sludge impacted soils would be (1) excavated, (2) neutralized with approximately 6,000 tons of calcium carbonate (15 % by

weight), (3) solidified with approximately 4,000 tons of Portland cement (10% by weight), and (4) placed back into the excavation and compacted in lifts.

#### **Sludge Remedy Alternative 4 – Engineered Fill on Perimeter Slope of Waste Pits:**

This alternative would involve excavating soils on the outer slope of the former waste pits to 5 feet inside the crest and to a depth of 13 feet, placing and compacting engineered fill in the excavation, and rebuilding the perimeter slopes of the former waste pit disposal area. The site would then be capped with a RCRA cap, see alternative 2 for description of RCRA cap.

Bench scale testing was conducted on the liquid/tar/sludge impacted soils to determine optimal calcium carbonate addition rates for pH adjustment of the acidic liquid/tar/sludge at the site. The objective was to increase the pH above 5 for the neutralized material while eliminating the potential for sulfur dioxide gas to form during the treatment process. The Portland cement will act as a binding agent that will increase the compressive strength of the treated material, decrease its permeability, and create a buffer zone between the remaining untreated soils within the site and the RCRA cap.

Approximately 12,000 cubic yards of liquid/tar/sludge impacted soils would be excavated and placed on site. Approximately 12,000 cubic yards of engineered fill, i.e. soil cement or equivalent, would be placed in the excavation and compacted. The engineered fill will provide the compressive strength, reduced permeability, and create a buffer zone between the remaining untreated soils within the site and the RCRA cap.

#### **Sludge Remedy Alternative 5 – Neutralize and Solidify Seeps, Engineered Fill, and Solidify Perimeter of Waste Pits:**

This alternative would involve neutralizing the liquid/tar/sludge seeps with calcium carbonate and solidifying with Portland cement. It also includes excavating and reconstructing the former waste pits perimeter outer wedge to 10 feet inside the crest with engineered and solidified fill that is benched into the untreated soils to a depth of 13 feet. The site would then be capped with a RCRA cap, see alternative 2 for description of RCRA cap.

The liquid/tar/sludge seeps located on the perimeter slopes will be; (1) excavated, (2) neutralized ex-situ with calcium carbonate (15% by weight), and (3) solidified with Portland cement (10% by weight). Neutralization with calcium carbonate will aid in the elimination of sulfur dioxide during the treatment process. The neutralized/solidified seep material will then be mixed with the engineered fill to recreate the perimeter slopes.

Approximately 25,000 cubic yards of engineered fill, i.e. soil cement or equivalent, would be placed in the excavation and compacted in lifts. The engineered and solidified fill will provide the compressive strength, reduced permeability, and create a buffer zone between the remaining untreated liquid/tar/sludge within the site and the RCRA cap.

### **Sludge Remedy Alternative 6 – Neutralize and Solidify Entire Waste Pit Disposal Area:**

This alternative would involve excavating the entire waste pit disposal area to a depth of 13 feet, neutralizing with calcium carbonate and solidifying with Portland cement the excavated sludge and soil, and placing and compacting the treated soil back into the excavation. An impermeable cap would be constructed over the treated soil.

Bench scale testing was conducted on the liquid/tar/sludge impacted soils to determine optimal calcium carbonate addition rates for pH adjustment of the acidic liquid/tar/sludge at the site. The objective was to increase the pH above 5 for the neutralized material while eliminating the potential for sulfur dioxide gas to form during the treatment process. The Portland cement would act as a binding agent that will increase the compressive strength of the treated material and decrease its permeability.

Approximately 80,000 cubic yards of liquid/tar/sludge impacted soils would be; (1) excavated, (2) neutralized with approximately 17,000 tons of calcium carbonate (15% by weight), (3) solidified with approximately 17,000 tons of Portland cement (10% by weight), and (4) placed and compacted in lifts within the boundary of the site.

The impermeable cap would consist of 6 inches of sand between the neutralized/solidified material and a GCL or 60-mil textured HDPE liner, a drainage layer (geosynthetic or gravel), and a 2 foot vegetative layer. The cap would be designed and constructed to promote drainage, minimize erosion, and provide long term minimization of migration of liquids through the cap. Long term operation and maintenance (O&M) would insure the integrity of the cap.

### **Sludge Remedy Alternative 7 – Neutralize and Solidify Perimeter of Waste Pits and Neutralize Interior of Waste Pits:**

This alternative would involve neutralizing with calcium carbonate and solidifying with Portland cement the perimeter of the former waste pits outer ring to 10 feet inside the crest and to a depth of 13 feet, and neutralizing with calcium carbonate the interior of the waste pits to a depth of 13 feet. An impermeable cap would be constructed over the treated soil, see alternative 6 for description of impermeable cap.

Approximately 80,000 cubic yards of liquid/tar/sludge impacted soils will be excavated and neutralized with approximately 17,000 tons of calcium carbonate (15 % by weight). Following neutralization, approximately 25,000 cubic yards of the original 80,000 cubic yards will be solidified with Portland cement (Refer to Alternative 3 for approximate quantity of Portland Cement). The Portland cement solidified material will be utilized to construct the perimeter dikes/slopes of the site. The Portland cement will act as a binding agent that will increase the compressive strength of the treated material and decrease its permeability.

**Sludge Remedy Alternative 8 - Neutralize Entire Waste Pit Disposal Area and Engineered Fill:**

This alternative would involve excavating the entire waste pit disposal area to a depth of 13 feet, neutralizing with calcium carbonate the excavated soils, then placing and compacting the treated soil back in the excavation. An impermeable cap would be constructed over the treated soil, see alternative 6 for description of impermeable cap.

Approximately 80,000 cubic yards of liquid/tar/sludge impacted soils will be excavated and neutralized ex-situ with approximately 17,000 tons of calcium carbonate (15 % by weight). Following neutralization, the neutralized material will be placed and compacted in lifts to design grades and contours.

# M E M O R A N D U M

TO: Ken Obenauf

FROM: Paul Lear

SUBJECT: Limestone Layer Neutralization of Tar Seep Material  
IT Project 819755

Date: 6/01/01

Based on our previous discussion and the results of the bench neutralization testing, I would recommend placing a 4-inch to 6-inch layer of less than ½-inch limestone as the first step in capping the tar seep material. This layer will react with and neutralize any tar material which may seep in the future. The limestone layer, and the limestone-neutralized material, will also serve as a seal to restrict the amount of seepage.

A typical seep has been described as occurring over a 2-foot by 2-foot area and having an approximate volume of 10-15 gallons of seeped tar. At a compacted density of 70 lb/ft<sup>3</sup>, a 4-inch layer of limestone over that area will have sufficient limestone to neutralize 18.6 gallons of tar. A similarly compacted 6-inch layer will have sufficient limestone to neutralize 28 gallons of tar.

Since the limestone emits carbon dioxide during the neutralization, the limestone-neutralized material will tend to expand slightly. Since the limestone layer will be confined by compacted material above it, this expansion should tend to push into the tar and slow the seepage. The neutralization reaction with the calcium carbonate is typically considered:



The less than ½-inch limestone was chosen to balance reactivity with dust control. The immediate reactivity of limestone increases with decreasing particle size. Ground limestone (less than 10 mesh) is typically used for neutralization purposes due to its higher reactivity. However, the less than 10 mesh limestone will be very dusty and difficult to compact. Less than ½-inch limestone will have a majority of its material less than 10 mesh, but have less dusting and compaction problems during placement.

If you have any further questions or concerns, please feel free to call me at 865-694-7316 or e-mail me at [plear@theitgroup.com](mailto:plear@theitgroup.com).

# M E M O R A N D U M

TO: Ken Obenauf

Date: 5/31/01

FROM: Paul Lear

SUBJECT: Bench Neutralization Tests of Tar Seep Material from the Purity Oil Site  
IT Project 819755

A 1-gallon composite sample of the tar seep material from the Purity Oil Sale Superfund site was received at the IT Corporation's Technology Development Laboratory on May 30, 2001 for neutralization treatability testing. The objective of the neutralization treatability testing was to determine the most effective neutralization reagent and the additive rate for the neutralization of tar seep material. The treated material was also to be non-tacky after treatment.

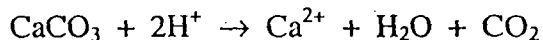
The composite sample was homogenized and analyzed for total solids, bulk density, and pH. The tar seep material had a total solids content of 84.1% and a bulk density of 71.8 lb/ft<sup>3</sup>. The pH of the tar seep sample was 1.30.

Portions (~200g) of the homogenized composite sample were mixed with a variety of reagents known to be effective for neutralization. These reagents included Portland cement, limestone (calcium carbonate), lime kiln dust, cement kiln dust, quicklime, Class C fly ash, and hydrated lime. The addition levels used were based on the amount of material required to modify the tarry nature of the sample. All formulations were mixed by hand until homogeneous. The treated material from all formulations was allowed to cure overnight. Portions of the treated material from all formulations were subjected to pH testing. The results are summarized in the following table.

Reagent	Mix Ratio	Final pH	Reagent	Mix Ratio	Final pH
Portland Cement	0.35	10.16	Quicklime	0.20	11.85
	0.45	10.82		0.30	11.93
Limestone	0.40	3.34	Class C Fly Ash	0.35	3.70
	0.50	3.83		0.45	3.97
Lime Kiln Dust	0.35	11.06	Hydrated Lime	0.30	7.24
	0.45	11.59		0.40	9.80
Cement Kiln Dust	0.35	4.54			
	0.45	4.44			

Based on the pH results and the handleability of the treated material, the use of limestone is recommended for the full-scale neutralization treatment. Though the final pH of the limestone-treated tar is less than the other alkaline reagents tested, the generation of carbon dioxide during the neutralization resulted in a treated material which was less tarry and less tacky. The pH of the tar seep material is above the RCRA corrosivity characteristic level of 2.5, so the limestone-treated tar would not be classified as a RCRA hazardous waste. The pH of the limestone-treated tar is within the pH range specified in the HDPE manufacturer specifications.

The neutralization reaction with the calcium carbonate is typically considered:



Based on the results above, a typical 25 ton load of limestone will be sufficient to treat 50 cubic yards of the tar material.

If you have any further questions or concerns, please feel free to call me at 865-694-7316 or e-mail me at [plear@theitgroup.com](mailto:plear@theitgroup.com).



Obenauf, Ken

From: Obenauf, Ken  
Sent: Thursday, May 31, 2001 11:18 AM  
To: 'Serrot (Graydon Renshaw)'  
Subject: HDPE Compatibility

Graydon:

Thanks for the charts you sent to me on the HDPE chemical compatibility. The text page says for certain chemical parameters the manufacturer must be notified. The following is a list of the chemical makeup of the Tar/sludges at the Purity Oil Superfund Site. A luptus paper test of the liquids next to some of the tars indicate a pH of 1 (or less).

Is the HDPE compatible for this material?

The following table shows the maximum measurement of each chemical at 5 different cross sections. (I am also sending the Excel if the formatting gets screwed up.)

Purity Oil Superfund Site  
Organic Concentrations for B Layer Soil (Tar/Sludge w/soil)  
(ppb)

Section	1	2	3	4	5
1,1,1 - Trichloroethane	4.1			3.8	3.8
2-Butanone		5.7	8.7	13	13
4-Methyl-2-Pentanone	3	9.1	1.4	3.1	
4-Methylphenol	56				27
Benzene	2.9	1.5	0.42	1.6	1.6
Bis (2-Ethylhexyl) Phthalate	9.2	8.3			
Chlorobenzene	2.9	1.6	0.82	0.82	1.9
Chrysene	6.4	6.9		60	60
Ethylbenzene	8.3	8.2	2	3.9	3.9
Ethylbenzene	1.4				
Florathene	4.6				
Phenol	99		8.3	8.3	
Tetrachloroethene	2.8	1.7	0.39	1.1	1.1
Toluene	17	15	4.8	4.8	16
Total Xylenes	45	48	13	20	20
Trichloroethane	9.8		0.75	4.4	4.4
Carbon Disulfide			0.77	0.77	
Benzo(b)fluoranthene				17	17
Benzo(k)fluoranthene				27	27
Benzo(a)anthracene				15	15
Chloroform				0.21	0.21
Tetrachloroethylene					4.4
1,2-Dichloroethane					0.29
Trichloroethylene					8.5

Kenneth S. Obenauf, P.E.  
kobenauf@theitgroup.com

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(925) 288-2248 Direct

Printed: 06/05/2001 9:05 AM

**Obenauf, Ken**

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**From:** Doug Wells [wellsd@serrot.com]  
**Sent:** Tuesday, June 05, 2001 9:15 AM  
**To:** 'KObenauf@theitgroup.com'  
**Cc:** Graydon Renshaw; Lance Reed  
**Subject:** HDPE Liner Chemical Compatibility

Dear Mr. Obenauf,

Thank you for sending the list of chemicals and concentrations for the Purity Oil Superfund Site. Serrot HDPE liner material is resistant to the chemicals on the list at the concentrations listed. If you have any questions please phone me at 800 237 1777.

# Chemical Resistance

## High Density Polyethylene

Chemical attack may be accompanied by any one or a combination of the following: swelling, discoloration, brittleness or loss of strength.

The following data is derived from laboratory tests using non-stressed immersed specimens under static conditions. The ratings shown are based mainly on chemical attack, solvent swelling and changes in physical properties under such conditions.

Legend: "S" - Satisfactory  
"O" - Some attack  
"U" - Unsatisfactory

Reagent	70°F	140°F
Acrylic Emulsions	S	S
Aluminum Chloride Dilute	S	S
Aluminum Chloride Concentrated	S	S
Aluminum Fluoride Concentrated	S	S
Aluminum Sulfate Concentrated	S	S
Ammonia 100% Dry Gas	S	S
Ammonium Carbonate	S	S
Ammonium Chloride Saturated	S	S
Ammonium Fluoride 20%	S	S
Ammonium Metaphosphate Saturated	S	S
Ammonium Persulfate Saturated	S	S
Ammonium Sulfate Saturated	S	S
Ammonium Sulfide Saturated	S	S
Ammonium Thiocyanate Saturated	S	S
Antimony Chloride	S	S
Barium Carbonate Saturated	S	S
Barium Chloride Saturated	S	S
Barium Sulfate Saturated	S	S
Barium Sulfide Saturated	S	S
Benzene Sulfonic Acid	S	S
Bismuth Carbonate Saturated	S	S
Black Liquor	S	S
Borax Cold Saturated	S	S
Boric Acid Dilute	S	S
Bromic Acid 10%	S	S
Bromide Liquid 100%	O	U
Butanediol 10%	S	S
Butanediol 60%	S	S
Butanediol 100%	S	S
Butyl Acetate 100%	O	U
Calcium Bisulfide	S	S
Calcium Carbonate Saturated	S	S
Calcium Chlorate Saturated	S	S
Calcium Hypochlorite Bleach Solution	S	S
Calcium Nitrate 50%	S	S
Calcium Sulfate	S	S
Carbon Dioxide 100% Dry	S	S

Reagent	70°F	140°F
Carbon Dioxide 100% Wet	S	S
Carbon Dioxide Cold Saturated	S	S
Carbon Monoxide	S	S
Chlorine Liquid	O	U
Chlorosulfonic Acid 100%	U	U
Chrome Alum Saturated	S	S
Chromic Acid 50%	S	O
Cider	S	S
Coconut Oil Alcohols	S	S
Copper Chloride Saturated	S	S
Copper Cyanide Saturated	S	S
Copper Fluoride 2%	S	S
Copper Nitrate Saturated	S	S
Copper Sulfate Dilute	S	S
Copper Sulfate Saturated	S	S
Cuprous Chloride Saturated	S	S
Cyclohexanone	U	U
Dextrin Saturated	S	S
Dextrose Saturated	S	S
Disodium Phosphate	S	S
Diethylene Glycol	S	S
Emulsions Photographic	S	S
Ethyl Chloride	O	U
Ferric Chloride Saturated	S	S
Ferric Nitrate Saturated	S	S
Ferrous Chloride Saturated	S	S
Ferrous Sulfate	S	S
Fluoboric Acid	S	S
Fluorine	S	U
Fluosilicic Acid 32%	S	S
Fluosilicic Acid Concentrate	S	S
Formic Acid 20%	S	S
Formic Acid 50%	S	S
Formic Acid 100%	S	S
Fructose Saturated	S	S
Fuel Oil	S	U
Glycol	S	S
Glycolic Acid 30%	S	S
Hydrobromic Acid 50%	S	S
Hydrocyanic Acid Saturated	S	S
Hydrochloric Acid 30%	S	S
Hydrofluoric Acid 40%	S	S
Hydrofluoric Acid 60%	S	S
Hydrogen 100%	S	S
Hydrogen Bromide 10%	S	S
Hydrogen Chloride Gas Dry	S	S
Hydroquinone	S	S
Hydrogen Sulfide	S	S
Hypochlorous Acid Concentrated	S	S

# Chemical Resistance

## High Density Polyethylene

Reagent	70°F	140°F
Lead Acetate Saturated	S	S
Magnesium Carbonate Saturated	S	S
Magnesium Chloride Saturated	S	S
Magnesium Hydroxide Saturated	S	S
Magnesium Nitrate Saturated	S	S
Magnesium Sulfate Saturated	S	S
Mercuric Chloride	S	S
Mercuric Cyanide Saturated	S	S
Mercuroous Nitrate Saturated	S	S
Methyl Ethyl Ketone 100%	U	U
Methyl Bromide	O	U
Methyl Sulfuric Acid	S	S
Methylene Chloride 100%	U	U
Nickel Chloride Saturated	S	S
Nickel Nitrate Concentrated	S	S
Nickel Sulfate Saturated	S	S
Nicotinic Acid	S	S
Nitric Acid <50%	S	O
Nitrobenzene 100%	U	U
Oleum Concentrated	U	U
Oxalic Acid Dilute	S	S
Oxalic Acid Saturated	S	S
Petroleum Ether	U	U
Phosphoric Acid 0 - 30%	S	S
Phosphoric Acid 90%	S	S
Photographic Solutions	S	S
Potassium Bicarbonate Saturated	S	S
Potassium Borate 1%	S	S
Potassium Bromate 10%	S	S
Potassium Bromide Saturated	S	S
Potassium Carbonate	S	S
Potassium Chlorate Saturated	S	S
Potassium Chloride Saturated	S	S
Potassium Chromate 40%	S	S
Potassium Cyanide Saturated	S	S
Potassium Ferri/Ferro Cyanide	S	S
Potassium Fluoride	S	S
Potassium Nitrate Saturated	S	S
Potassium Perborate Saturated	S	S
Potassium Perchlorate 10%	S	S
Potassium Permanganate 20%	S	S
Potassium Sulfate Concentrated	S	S
Potassium Sulfide Concentrated	S	S
Potassium Sulfite Concentrated	S	S
Potassium Persulfate Saturated	S	S
Propargyl Alcohol	S	S
Propylene Glycol	S	S
Rayon Coagulating Bath	S	S

Reagent	70°F	140°F
Sea Water	S	S
Shortening	S	S
Silicic Acid	S	S
Sodium Acetate Saturated	S	S
Sodium Benzoate 35%	S	S
Sodium Bisulfate Saturated	S	S
Sodium Bisulfite Saturated	S	S
Sodium Borate	S	S
Sodium Bromide Oil Solution	S	S
Sodium Carbamate Concentrated	S	S
Sodium Carbamate	S	S
Sodium Chlorate Saturated	S	S
Sodium Chloride Saturated	S	S
Sodium Cyanide	S	S
Sodium Dichromate Saturated	S	S
Sodium Ferricyanide Saturated	S	S
Sodium Ferrocyanide	S	S
Sodium Fluoride Saturated	S	S
Sodium Nitrate	S	S
Sodium Sulfate	S	S
Sodium Sulfide 25% to Saturated	S	S
Sodium Sulfite Saturated	S	S
Stannous Chloride Saturated	S	S
Stannic Chloride Saturated	S	S
Starch Solution Saturated	S	S
Sulfuric Acid <50%	S	S
Sulfuric Acid 85%	O	U
Sulfuric Acid 98% Concentrated	O	U
Sulfurous Acid	S	S
Tannic Acid 10%	S	S
Tetralin	U	U
Tetrahydrofuran	O	O
Transformer Oil	S	O
Trichloroacetic Acid 10%	S	S
Trisodium Phosphate Saturated	S	S
Urea	S	S
Urine	S	S
Wetting Agents	S	S
Xylene	U	U
Zinc Chloride Saturated	S	S
Zinc Sulfate Saturated	S	S

*The information contained herein has been compiled by Sero Corporation and is, to the best of our knowledge, true and accurate. This information is offered without warranty. Final determination of suitability for use contemplated is the sole responsibility of the user. This information is subject to change without notice.*

## HDPE Chemical Compatibility

### Chemical Compatibility of HDPE

High density polyethylene (HDPE) geomembranes are called upon to contain an infinite variety of chemicals making the question of compatibility a serious concern. There are a number of "chemical compatibility" charts in circulation, many published by chemical supply companies. These are of limited value due to the vague and often misleading ratings. How good is "good"? What criteria are used to determine "limited" compatibility versus "poor" compatibility? Definitive chemical compatibility charts are currently in development at Serrot International, Inc. These charts, still many months from completion, will rate geomembrane compatibility based on material property changes. Until the charts are completed, the following guidelines should be used when considering HDPE for containment of a particular chemical.

**Aromatic Halogenated Hydrocarbons** such as dichlorobenzene may slowly dissolve HDPE under continuous, concentrated exposure. Total concentrations up to 50 ppm should not present a problem. Long term exposure to higher concentrations may not present a problem but the manufacturer should be consulted.

**Aliphatic Halogenated Hydrocarbons** such as trichloroethylene, methylene chloride and chloroform tend to soften HDPE and reduce its yield strength while increasing permeability. There is no chemical attack on the HDPE and any short term effects are reversible upon removal of the liquid. Total concentrations up to 100 ppm should not present a problem. Long term exposure to higher concentrations may not present a problem but the manufacturer should be consulted.

**Aromatic Hydrocarbons** such as benzene, toluene and xylene affect HDPE in the same manner as halogenated hydrocarbons, but to a lesser extent. Total concentrations up to 200 ppm should not present a problem. Long term exposure to higher concentrations may not present a problem but the manufacturer should be consulted.

**Volatile and Semi-Volatile Organics** not covered above (including aliphatic hydrocarbons, ketones, aldehydes, esters, amides, alcohols and ethers) can also affect HDPE in a similar manner, but to a much lesser extent. Low molecular weight alcohols, ketones

and aldehydes may not present a problem for long term containment in concentrations up to 100%. Presence of short chain aliphatic hydrocarbons with no other functional groups may limit the use of HDPE to aqueous solutions. In general, total concentrations up to 1000 ppm should not present a problem. Long term exposure to higher concentrations may not present a problem but the manufacturer should be consulted.

**Oil and Grease** are the major constituents of non-volatile organics. Total concentrations up to 5% should not present a problem. Long term exposure to higher concentrations may not present a problem but the manufacturer should be consulted.

**Strong Oxidizers** such as potassium permanganate, potassium dichromate, chlorine, perchloric acid and peroxides can cause the geomembrane to become brittle over time. Total concentrations up to 10% for aqueous solutions at roughly room temperature should not present a problem. Long term exposure to higher concentrations may not present a problem but the manufacturer should be consulted.

**Acids** such as concentrated nitric, phosphoric or sulfuric acid are also oxidizers but different acids have different characteristics.

**The manufacturer should be consulted if a liner is going to be used in containing a solution with a pH of less than 2.**

**Bases** are generally not harmful to HDPE. A pH no greater than 13 should be maintained without consulting the manufacturer.

**Dissolved Metals, Salts and Nutrients** do not have an effect on HDPE and are not a concern.

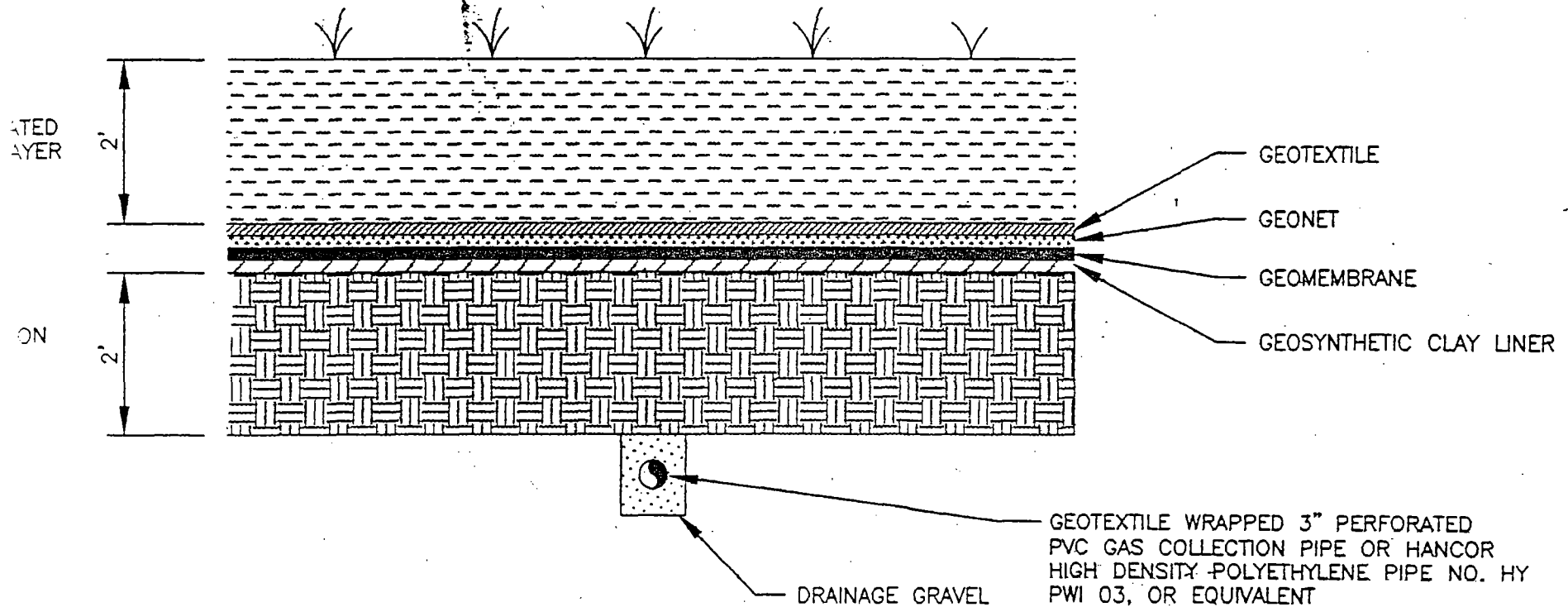
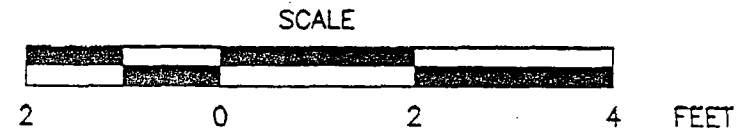
The information presented above should be considered only a starting point in evaluating the suitability of HDPE for containment of a particular chemical. Chemical concentration, duration of exposure and temperature of the solution are all contributing factors. Also, interactions between combinations of chemicals are more problematic than single chemicals. When a definitive answer as to chemical compatibility is required and existing data is insufficient to make a clear decision, Serrot International, Inc. recommends laboratory testing of the material in the specific liquid it is to contain.

(Serrot International, Inc. reserves the right to update the information contained herein or modify the product in accordance with technological advances.)

The information contained herein has been compiled by Serrot International, Inc. and is, to the best of our knowledge, true and accurate. This information is offered without warranty. Final determination of suitability for use contemplated is the sole responsibility of the user. This information is subject to change without notice. TN 008 4/17/01



TYPICAL GAS COLLECTION PIPE DAYLIG



TYPICAL GAS COLLECTION PIPE DETAIL

SCALE

# DRAFT

**NEUTRALIZATION REMEDIAL ACTION  
WORK PLAN FOR OU-2 CLOSURE  
PURITY OIL SALES SUPERFUND SITE  
MALAGA, FRESNO COUNTY, CALIFORNIA**

Prepared by:

SECOR International Incorporated  
2321 Club Meridian Drive, Suite E  
Okemos, Michigan 48864

August 22, 2003

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Jeremy M. Rasmussen, P.E.  
NO. 61494

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<b>APPENDIX D</b>	<b>In Place Density Data</b>
<b>APPENDIX E</b>	<b>Background Air Data Summary</b>
<b>APPENDIX F</b>	<b>Real-Time Air Monitoring Weekly Summaries</b>
<b>APPENDIX G</b>	<b>Air Sample Analytical Data Evaluations</b>
<b>APPENDIX H</b>	<b>Field Logs for Real-Time Air Monitoring</b>

## 1.0 INTRODUCTION

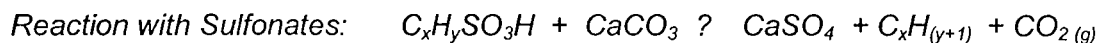
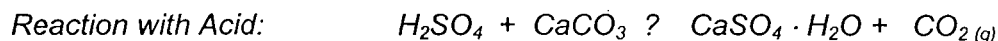
Based on recommendations from the United States Environmental Protection Agency (USEPA) Region IX, and results of the neutralization pilot tests, conducted by ChevronTexaco, EPA will modify the remedy for Operable Unit 2 (OU-2) at the Purity Oil Sales Superfund Site in Malaga, California. During an August 2002 meeting with ChevronTexaco, USEPA presented seven conceptual remedial alternatives, one of which included neutralizing the entire waste layer (typically consisting of sludge, soil, and debris of various amounts) with calcium carbonate. At follow-up meetings in September and October 2002, ChevronTexaco proposed to evaluate the neutralization process as part of a comprehensive proposal to address pending issues at the Site.

In April 2003, ChevronTexaco initiated a neutralization pilot test, in accordance with the USEPA conditionally-approved document; *Neutralization Pilot Test Work Plan For OU-2 Closure, Purity Oil Sales Superfund Site, Malaga, Fresno County, California*. The purpose of the pilot test was to identify and define procedures that will be protective of human health and the environment. Procedures investigated during the pilot test included neutralization activities, backfill and material handling scenarios, quality assurance testing, health and safety oversight, and air monitoring and sampling. The pilot test was intended to determine the most effective neutralization procedures for OU-2 sludges. The results of the pilot test were discussed extensively with USEPA at a meeting on June 3, 2003. The neutralization pilot testing was successfully completed in June 2003.

This Remedial Action Work Plan (RAWP) details the full-scale sludge neutralization process that SECOR International Incorporated (SECOR) proposes to implement within OU-2. Final design components to be constructed after neutralization, such as the final capping configuration and surface drainage features, will be addressed in a RAWP addendum.

### 1.1 NEUTRALIZATION CHEMISTRY

Neutralization of acidic sludge can be accomplished by mixing with calcium carbonate. The calcium carbonate reacts with residual sulfuric acid in the sludge and also with sulfonated functional groups in the tarry matrix to convert the sulfate acidity into calcium sulfate via the following reactions:



These neutralization reactions occur together to create a mixture of calcium sulfate salts and tar. The mixture also contains some carbonic acid, created by the release of carbon dioxide gas absorbed by moisture in the soils and sludge. The reaction requires moisture to proceed, but the water content in the sludge (approximately 20 percent by weight) is generally sufficient to drive the reaction.

The dosage requirements for calcium carbonate are dependent upon the type of sludge being neutralized. The filter cake sludge observed across much of the Site typically has low acidity and it usually requires less than ten percent calcium carbonate by weight for neutralization. Initial bench scale testing of the "worst case" sludge material observed in the western portion of the Site indicated that calcium carbonate additions of 30 to 40 percent may be required for neutralization. However, pilot testing indicated that only a small fraction of the acid sludge is comprised of this "worst case" material; only 12 of the 58 neutralized batches contained sludge with calcium carbonate demands exceeding 15 percent by weight. Although individual batches may require calcium carbonate doses of 30 percent or more, the site-wide average dose is expected to range from 15 to 20 percent.

## **1.2 STRENGTH OF NEUTRALIZED MATERIALS**

The neutralized mixture of calcium carbonate and acid sludge has very little shear strength. Therefore, overburden soil will be mixed with the acid sludge and calcium carbonate to give the final product sufficient strength to support the final cap configuration. Minimum strength requirements were determined by the slope stability assessment and geotechnical analyses provided in Appendix A. Initial bench scale testing (Appendix B) shows that the addition of three parts soil (by weight) to the "worst case" sludge can provide sufficient strength to support the final cover.

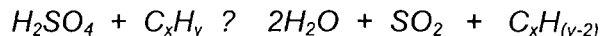
Samples of the neutralized waste layer material were prepared at the bench scale level using three parts soil to one part sludge, and nine percent calcium carbonate to the total mixture by weight. The final mixture had an immediate pH of 4.3. However, when the mixture was allowed to react and vent carbon dioxide for one hour prior to pH testing, the pH of the mixture increased to 5.9. Testing the sample to establish a moisture/density relationship showed that the optimum water content of the soil/sludge mixture was approximately eight percent. Results from this testing also indicated that the strength of the material decreased significantly when the water content exceeded 11 percent.

During the pilot tests, water content was tracked carefully to ensure the final batches were capable of producing acceptable compacted densities. However, after several batches had been completed, the mixed material was found to be much less sensitive to water content than expected. Acceptable compaction results were obtained from batches with water contents ranging from 7.6 to 14.5 percent.

Testing indicates the sludge contains approximately 20 percent moisture and the water content for Site soils ranges from 7 to 10 percent. This is enough moisture to drive the neutralization reactions to a pH value above 5.0 if the material is allowed to react for a minimum of one hour prior to testing. Therefore, calcium carbonate will be added to the soils as a wetted, fine granular material in the size range of 16 to 200 mesh. The calcium carbonate will be wetted by the manufacturer prior to shipment to minimize dusting during unloading. If required, water will be added on a controlled basis during mixing to minimize dust without compromising the strength characteristics of the material.

### 1.3 NEUTRALIZATION GOAL

The purpose of neutralization is to eliminate residual sulfuric acid from the sludge so sulfur dioxide gas cannot form. Sulfuric acid can react with the hydrocarbons in the sludge to release sulfur dioxide by the following oxidation reaction:



Sulfuric acid concentrations above 60 percent are generally required for this reaction to occur. Because the acidic sludge at the Site contains acid at much lower concentrations than 60 percent, sulfur dioxide gases are unlikely to form by oxidation reactions. Instead, small amounts of sulfur dioxide are likely to exist as microscopic gas pockets in the sludge matrix. These micro-pockets are entrained during purification processes when petroleum products are contacted with concentrated sulfuric acid. Nonetheless, neutralization of all residual sulfuric acid in the sludge assures the oxidation of hydrocarbons can no longer occur, thereby eliminating the potential threat of sulfur dioxide gas formation in the future.

### 1.4 NEUTRALIZATION PILOT TEST SUMMARY

Between April and June 2003, a sludge neutralization pilot study was conducted on excavated OU-2 waste layer material. During the sludge neutralization pilot test activities, approximately 21,000 tons of material were excavated and mixed to attain a pH of 5.0 or greater. The "worst-case" locations were chosen based on historical boring logs and analytical data, which indicate the existence of sludge-impacted soil as well as a range of chemicals that might exceed the Tier III levels for air emissions upon excavation.

Overburden soils and sludge-impacted materials were excavated and segregated into three separate stockpiles prior to mixing. Approximately 13,500 tons of soil, 6,500 tons of sludge-impacted material, and 700 tons of large concrete and debris were excavated and segregated.

Batch sizes ranged from 200 to 900 tons of neutralized material. Neutralization was completed in a two-step process; calcium carbonate was initially mixed with waste layer material to provide maximum reagent contact with the sludge, and then overburden soils were added and the entire batch was mixed again. The amount of calcium carbonate required to neutralize the sludge-impacted materials was calculated as a percent (by weight) of sludge-impacted material for each batch. The required reagent was determined by field titrations. The weight percentage of calcium carbonate to sludge ranged from 5 to 28 percent during the pilot study. Approximately 850 tons of calcium carbonate were used in the pilot neutralization process, representing approximately 4 percent by weight of the total neutralization recipe. Neutralized batch pHs ranged from 5.0 to 7.5, with an average pH of 6.2. All batches met the 5.0 pH criteria for neutralization. Upon obtaining the desired pH, each batch was removed from the mixing area and stockpiled for placement and compaction. Appendix C contains a summary of the neutralization data collected in the field for all neutralized batches.

Neutralization during the first three weeks of pilot testing was conducted using an excavator to blend the sludge-impacted material, calcium carbonate, and soils. After the third week, an excavator-mounted mixing head was used to mix the excavated materials. The mixing head is a toothed drum attachment that can be rotated at 100 rpm to blend the neutralized materials. Operating with the excavator-mounted mix head increased batch sizes and decreased mixing times without sacrificing mix quality. The only limitation encountered with the mix head occurred in debris-laden material where the excessive concrete would damage the attachment. In this case, mixing was completed with the excavator bucket.

Various mix recipes were also evaluated during neutralization activities. Initial batches were prepared at a volume ratio of three parts overburden soil to one part waste layer material, as prescribed by initial bench scale testing results. However, due to the presence of significant amounts of soil and debris in the waste layer (often as high as 50 percent), lower mix ratios were examined. Batches were reduced to a mix ratio of two parts soil to one part waste layer material for the majority of the pilot tests and successful batches were completed at ratios as low as one to one. Appendix A contains compaction test results for overburden to waste layer ratios of 1.5:1 and 1:1, as well a batch in which previously neutralized material was mixed with waste layer material at a ratio of 2:1. All batch recipes conducted during the pilot tests exhibited sufficient strength properties to support the slope stability analysis.

Approximately 4,000 cubic yards of neutralized material were placed and compacted on the west end of the Site. Neutralized material was placed in 12-inch lifts and compacted with a sheep's-foot compactor. Density testing was completed in random areas to ensure the compacted material met or exceeded the 107 pounds per cubic foot (pcf) wet density criteria required to support the slope stability analysis (Appendix A). All tests met or exceeded this requirement. Appendix D contains a summary of the field density data for the neutralized sludge/soil mixture after compaction.

During the first two weeks of backfill and compaction, sand cone, drive cylinder, and nuclear density gauge testing were conducted to determine which of these tests (if any) could be used to verify the density of the neutralized material. Nuclear gauge results provided accurate wet density measurements, but inaccurate water content readings due to the presence of sludge in the material. Sand cone tests provided reliable density and water content measurements, but the results were consistently higher than those for the drive cylinder. Of the three tests, the drive cylinder provided the most conservative and consistent measurements for compacted soil density and water content. Approximately 65 field density tests were conducted with a drive cylinder on the compacted backfill, with an average density of 115 lbs/ft<sup>3</sup>, and an average water content of 10 percent.

Debris larger than two feet in size was separated from the excavated material and placed in lifts during the backfill process. Large pieces of concrete were broken into manageable sizes and lifts of concrete and debris were placed in the center of the backfill footprint (inside the perimeter slopes) and surrounded by a minimum of one foot of compacted neutralized soil. Concrete was placed by excavator to minimize void space and neutralized material was placed and compacted directly above each lift. Approximately 300 tons of debris was placed within the footprint of the excavated material.

## **1.5 PILOT TEST AMBIENT AIR MONITORING**

An ambient air monitoring program was implemented during the neutralization pilot test to document potential airborne exposures to construction workers and to an individual at the property boundary. The ambient air monitoring program consisted of real-time monitoring data collected using field instruments on-site and at the property boundary. In addition, daily composite samples were collected from four air monitoring stations located at the property boundary. These composite samples were analyzed for total suspended particulates (TSP) and metals at all four locations. At two of the air monitoring stations (one near the Golden State Market and one near the mix area), samples were also collected for respirable particulates (PM10), volatile organic constituents (VOCs), semi-volatile organic constituents (SVOCs), and sulfur compounds.

### **1.5.1 Establishment of Background Conditions**

Air samples were collected at the four monitoring stations for five days prior to commencing the neutralization pilot test. The purpose of this sampling was to establish background conditions at the Site. The daily composite samples were analyzed for TSP, PM10, metals, VOCs, SVOCs and sulfur compounds. A summary of the background data is contained in Appendix E.

### **1.5.2 Pilot Study Real-time Air Monitoring Summary**

Real-time air monitoring was conducted in the construction (breathing) zone during pilot study activities to ensure worker safety. Breathing zone real-time monitoring was conducted every 15 minutes (four times per hour) at a minimum, and at downwind off-site locations or at the downwind Site perimeter, as necessary. No permissible health and safety exposure limits were exceeded for any real-time air monitoring parameters during pilot study construction activities.

This data demonstrates the effectiveness of the best management practices (BMPs) implemented during the pilot tests, such as real-time air monitoring, use of calcium carbonate, and use of dust and odor suppressant when necessary. SECOR proposes to continue the on-site real-time air monitoring program throughout the duration of the full-scale neutralization program to ensure protection of on-site workers and potential off-site receptors.

Real-time air monitoring action levels (discussed in greater detail in Section 2.3.1.1) were developed to initiate various activities that must be implemented to protect off-site receptors as well as the on-site workers. Response Levels 1 and 2 are dependent upon air monitoring results obtained in the construction zone. If Level 1 concentrations were observed, increased surveillance of the real-time instruments in the construction zone was conducted. If Level 2 concentrations were observed, increased emission controls were implemented, and if necessary, upgrades to personal protective equipment were implemented. Response Level 3 is dependent upon air monitoring results measured at the Site perimeter or off-site location. If Level 3 concentrations were measured and sustained for 30 consecutive minutes at the Site perimeter or off-site locations, work activities would have been temporarily suspended (this situation did not occur during the neutralization pilot study). Additional emission controls/BMPs must be implemented at the construction zone if Level 3 concentrations are observed, with work

activities resuming once real-time air monitoring results below Level 3 are sustained at the Site perimeter or off-site location for 15 minutes.

Real-time monitoring action levels are summarized in Table 2. As requested by USEPA, summaries of the real-time air monitoring data in comparison to the action levels were prepared for each of the nine weeks of the pilot study and are found in Appendix F. A brief summary for each group of parameters is included below.

#### ***Volatile Organic Compounds (VOCs)***

During the on-site real-time monitoring, occasional measurements of VOCs exceeded Project Response Level 1 (5 ppm), however, these measurements were not sustained for longer than the five minutes required to initiate a response. Project Response Level 2 (20 ppm) was only exceeded by occasional measurements during Week 7, however, these measurements were not sustained for longer than five minutes. During the off-site real-time monitoring, occasional discrete measurements of VOCs exceeded Project Response Level 3 (5 ppm), however, these measurements were not sustained for longer than five minutes (please note, off-site measurements were only compared to Level 3, as shown in Table 2).

#### ***Hydrogen Sulfide and Sulfur Dioxide***

During the on-site real-time monitoring, occasional discrete measurements of sulfur dioxide and hydrogen sulfide exceeded Project Response Level 1 (2 ppm for sulfur dioxide, 5 ppm for hydrogen sulfide) for Week 3, and Project Response Levels 1 and 2 (5 ppm for sulfur dioxide, 10 ppm for hydrogen sulfide) for Weeks 1, 2, and 7, however, these values were not sustained for longer than five minutes. During the off-site real-time monitoring, occasional discrete measurements exceeded Project Response Level 3 (1 ppm for sulfur dioxide, 2 ppm for hydrogen sulfide), however, these levels were not sustained for longer than five minutes.

#### ***Respirable Particulates (PM<sub>10</sub>)***

During the on-site real-time monitoring, occasional discrete measurements of respirable particulate matter exceeded Project Response Levels 1 (0.9 mg/m<sup>3</sup>) and 2 (1.8 mg/m<sup>3</sup>), however, they were not sustained for longer than five minutes. Average concentrations of respirable particulate matter were less than Project Response Level 1. During the off-site real-time monitoring, occasional measurements of respirable particulate matter exceeded Project Response Level 3 (0.45 mg/m<sup>3</sup>), however, they were not sustained for longer than five minutes. Average concentrations of respirable particulate matter were less than Project Response Level 3.

### **1.5.3 Pilot Study Air Sampling Preliminary Summaries**

Air sampling activities during the pilot study consisted of sampling at the four stations (S1, S2, S5, and S6) positioned at the Site perimeter. Samples were collected for each 24-hour period when neutralization activities occurred, and were analyzed for a total of 109 constituents. Concentrations measured at these air monitoring stations were compared against a multi-tiered data evaluation tool that mandated response actions based on concentration limits established for each tier. USEPA provided Draft Risk-Based Trigger Concentrations in Air for Off-Site Exposure Locations, which were developed using conservative exposure assumptions, including receptor exposure for 12 hours per day, seven days per week for a duration of six

months (actual pilot study work activities were typically conducted for five days per week for a nine-week duration); and an acceptable cancer risk of  $1 \times 10^{-6}$  (a range of cancer risk from  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$  is typically acceptable). These conservative USEPA-provided concentrations were used as Tier I levels. Tier I response actions required continued monitoring for constituents detected in samples that exceeded the Tier I concentrations. Concentrations that exceeded the Tier II levels required the implementation of BMPs at the Site. Exceedances of a Tier III level dictated a shut down of work activities until engineering controls could be implemented. Appendix G contains a table summarizing the screening levels associated with the multi-tiered evaluation approach used in the neutralization pilot study.

There are approximately 8,200 total air sampling data points recorded from all four sampling stations for Weeks 1 through 9 (not including TSP, PM10, laboratory quality assurance samples, blanks, etc.), with approximately 2,150 constituents (26%) detected above their Method Detection Limit (MDL). Of these detected constituents, approximately 14% (or 310) were detected above their Tier I Trigger Concentrations (TCs). This data indicates that roughly 4% of all data points exceeded a Tier I TC (310 out of 8,200). All data from Weeks 1 through 9 of the pilot study have been received and a Preliminary Summary of Neutralization Pilot Study Air Sample Analytical Data has been prepared for each week. These summaries can be found in Appendix G. Findings from these weekly summaries are presented below.

#### ***Semi-Volatile Organic Compounds (SVOCs)***

The only SVOCs detected in the pilot study air samples were acenaphthene, fluorene, naphthalene, 2-methylnaphthalene, and phenanthrene. Each of these constituents (except 2-methylnaphthalene, which was not analyzed in background samples) was detected in the pre-construction background samples. None of these constituents were detected in the pilot study samples above the Tier I TCs, and the concentrations were either at or slightly above background concentrations. Since no SVOCs were detected above the Tier I TCs, SVOCs will not be analyzed during the full-scale neutralization program (as detailed in Section 2).

#### ***Total Suspended Particulates (TSP) and Metals***

TSP concentrations ranged from  $33 \text{ ug/m}^3$  to  $971 \text{ ug/m}^3$  during the pilot study. The maximum background concentration was  $600 \text{ ug/m}^3$ , which was only exceeded in Week 6 when significant dust was blowing onto the Site from upwind locations. TSP concentrations fall far below the Occupational Safety & Health Administration (OSHA) Permissible Exposure Limit (PEL) for total particulate matter of  $15,000 \text{ ug/m}^3$ .

The following metals were detected in background samples collected prior to neutralization pilot study activities: aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, silver, vanadium, and zinc. Of these metals, chromium and manganese were detected in background samples above their Tier I TCs. The metals detected in the background samples were also detected in the samples collected during the nine-week pilot study. The metals detected in the pilot study samples were measured at concentrations within the range of concentrations detected in the background samples.

The background data were statistically evaluated to determine the average concentrations and the 95 percent upper confidence levels (95 UCLs) of the metals detected, and the pilot study



sample results were compared to these levels. A memorandum summarizing the background evaluation is presented in Appendix E.

Only 5 of 18 metals analyzed were detected in pilot study samples above the Tier I TCs: aluminum, barium, cadmium, chromium, and manganese. Approximately 2,500 metals analyses (not including quality assurance samples) were conducted, and approximately 9% were detected above Tier I TCs. No metals were detected above the Tier II TCs. With the exception of one manganese detection at Station S1 (on the north side of the Site adjacent to Bruno's Iron & Metal), all chromium and manganese detections were within the range of background concentrations. Cadmium was only detected in one sample (collected at Station S1) at a concentration slightly above its Tier I TC. Aluminum was only detected in seven samples collected during Weeks 6, 7, and 9 at concentration above its Tier I TC. Six of these seven samples were collected on two days during which significant dust was blowing onto the Site from upwind locations. Barium concentrations above Tier I were attributed to filter media used during Week 1 and a portion of Week 2; once the filter media was changed during Week 2, barium concentrations detected were similar to those found in background samples.

Exposure point concentrations (EPCs), which are reasonable estimates of the concentration likely to be contacted over time, were calculated for the pilot study sample results. These EPCs, which were represented by the 95 UCL calculated for the appropriate distribution type (i.e., normal or lognormal), were compared to the Tier I TCs. Only the EPCs for chromium and manganese exceeded the Tier I TCs, as summarized in a memorandum presented in Appendix G.

Since EPCs for metals are below Tier I TCs and/or metal concentrations are within background levels, metals (with the exception of lead) will not be analyzed during the full-scale neutralization program. Lead, though detected at concentrations well below the Tier I TC, will continue to be analyzed, since it was one of the primary constituents detected at elevated concentrations in Site soil. Periodic monitoring of TSP and lead will be conducted to ensure that off-site receptors will be protected.

#### ***Respirable Particulates (PM10)***

PM10 concentrations ranged from 8.2 ug/m<sup>3</sup> to 278 ug/m<sup>3</sup>. The maximum background concentration of PM10 was 104 ug/m<sup>3</sup>, which was only exceeded in Week 6. California's Ambient Air Quality Standard for PM10 is 50 ug/m<sup>3</sup> over a 24-hour period, however, Fresno is located in a "non-attainment" zone for PM10. The Federal PM10 24-hour standard is 150 ug/m<sup>3</sup>, which was only exceeded on one day of sampling in Week 6, and the OSHA PEL for respirable particulate matter is 5,000 ug/m<sup>3</sup>, which was not exceeded. The PM10 data collected from the pilot study correlates well with the TSP data. Therefore, PM10 sampling will not be conducted during full-scale neutralization, and estimates of PM10 will be made from the TSP data. A memorandum summarizing the correlation between PM10 and TSP is included in Appendix G.

#### ***Sulfur Compounds***

Sulfur compounds were detected in the data from Weeks 3 through 9. The only sulfur compound detected for which TCs were developed by USEPA was hydrogen sulfide, though dimethyl sulfide, carbon disulfide, and carbonyl sulfide were also detected. The maximum

concentration of hydrogen sulfide was 0.033 ppm (33 ppb), which is above its Tier I TC of 0.000969 ppmv (0.969 ppb), but below its Tier II TC of 1.33 ppmv (1,330 ppb) and Tier III TC of 4.76 ppmv (4,760 ppb).

The Tier I TC for hydrogen sulfide was based on its Inhalation Reference Dose of  $2.9 \times 10^{-4}$  mg/kg/day, and was calculated to be  $1.36 \text{ ug/m}^3$ , or approximately 1 ppb. The Tier I screening level for hydrogen sulfide is extremely conservative. Hydrogen sulfide standards set by other agencies are significantly higher than the Tier I TC.

OSHA has set forth the PEL of an acceptable ceiling concentration for hydrogen sulfide of 20 ppm (20,000 ppb) and an acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift at 50 ppm (50,000 ppb) for a maximum duration of ten minutes.

The Agency for Toxic Substances and Disease Registry (ATSDR) has established Minimal Risk Levels (MRLs), defined as "an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure." The inhalation MRL for an "acute" duration for hydrogen sulfide is 0.07 ppm (70 ppb).

In *TLVs & BEIs: Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices for 2002*, the American Conference of Governmental Industrial Hygienists (ACGIH) has established an 8-hr Time Weighted Average (TWA) of 10 ppm (10,000 ppb), which was defined to represent "conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects." The ACGIH also established a Short-Term Exposure Limit (STEL) of 15 ppm (15,000 ppb), which was defined to represent "the concentration to which it is believed that workers can be exposed continuously for a short period of time without suffering from; 1) irritation, 2) chronic or irreversible tissue damage, or 3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue, or materially reduce work efficiency."

Finally, the American Industrial Hygienist Association (AIHA) has developed the following Emergency Response Planning Guidelines (ERPGs) for hydrogen sulfide to protect the general public against exposure to airborne contaminants that may occur during spill or release events:

- ERPG(1): level at which for up to one hour exposure, no more than mild, transient effects are experienced (0.1 ppm for hydrogen sulfide);
- ERPG(2): level at which for up to one hour exposure, without serious, adverse effects (30 ppm for hydrogen sulfide);
- ERPG(3): level at which for up to one hour exposure, not life threatening (100 ppm for hydrogen sulfide).

The maximum hydrogen sulfide concentration (0.033 ppm) detected in the air samples at the Site (as well as the Tier I screening levels) are well below these standards.

Based upon a review of the available guidance documents, the Tier I criteria for hydrogen sulfide will be modified to be more consistent with other guidance intended to protect the general public against exposure to hydrogen sulfide. Accordingly, the ATSDR acute inhalation

MRL of 0.07 ppm will be used as the Tier I screening level for hydrogen sulfide during the full-scale neutralization program. Sulfur compounds will be analyzed during full-scale neutralization.

#### ***Volatile Organic Compounds (VOCs)***

VOCs were detected in the background samples as well as samples collected during Weeks 1 through 9 of the pilot study. In Weeks 1, 3, and 6, no VOCs were detected above the Tier I TCs. In the remaining weeks, several VOCs were detected above Tier I TCs, and in Weeks 2, 4, 5, and 8 some constituents were detected above the Tier II TCs. No VOCs were detected above the Tier III TCs.

The VOCs detected above both the Tier I and Tier II TCs are presented in the following table:

	Maximum Concentration (ppmv)	Tier I TC (ppmv)	Tier II TC (ppmv)	Tier III TC (ppmv)
<b>1,1,2,2-Tetrachloroethane</b>	0.004	0.000242	0.00242	0.0242
<b>Hexachlorobutadiene</b>	0.0048	0.000132	0.0015	5.36
<b>Methylene chloride</b>	0.62	0.027	0.27	1.72
<b>Trichloroethene</b>	0.0041	0.00015	0.0015	23.8

These constituents were also compared to the AIHA guidance concentrations. A summary of these constituents and their chemical-specific ERPGs is included below.

	ERPG(1)	ERPG(2)	ERPG(3)
<b>1,1,2,2-Tetrachloroethane</b>	na	na	na
<b>Hexachlorobutadiene</b>	3.0 ppm	10 ppm	30 ppm
<b>Methylene chloride</b>	200 ppm	750 ppm	4,000 ppm
<b>Trichloroethene</b>	100 ppm	500 ppm	5,000 ppm

The VOC concentrations exceeding the Tier II TCs are well below the ERPG(1) levels (no ERPG exists for 1,1,2,2-Tetrachloroethane). In addition, it should be noted that the Tier III TCs identified above are also significantly lower than the ERPG(1) levels for each compound.

Though the VOCs were detected at concentrations below the ERPG levels, samples will be collected and analyzed for VOCs during full-scale neutralization to ensure off-site receptors are protected.

## **2.0 SCOPE OF WORK**

### **2.1 NEUTRALIZATION PROCEDURES**

This RAWP outlines the full-scale sludge neutralization procedures to be conducted within OU-2 at the Purity Site. The intent of this RAWP is to detail the procedures that will be protective of human health and the environment, including neutralization activities, backfill and material handling activities, quality assurance testing, health and safety oversight, and air monitoring and sampling.

The following general tasks will be conducted to complete this scope of work:

- Neutralization of OU-2 Sludges;
- Material Handling and Debris Management;
- Excavation Observation and Recording;
- Neutralized Material Density Testing;
- Performance Monitoring and Quality Assurance; and
- Health and Safety Air Monitoring and Sampling.

#### **2.1.1 Methodology**

Sludge neutralization will include ex-situ mixing of all materials found in the waste layer at the Site. The material encountered in the waste layer is variable, but can generally be categorized into five types. These five materials include:

- Material excavated from the Fresno Irrigation District (FID) easement;
- Tarry sludge from the Site's west end;
- Filter cake sludge from near the Site's center;
- Debris-laden sludge and soil from the Site's south side and center portion; and
- Soil-prevalent material from the Site's east end.

Locations along the FID easement where visible sludge is identified outside of the cap footprint will also be addressed during neutralization procedures. The sludge originating from the Site will be excavated, even if the sludge extends onto off-site properties.

The limits of off-site waste layer excavation will be visually determined by the oversight engineer, and will be confirmed as necessary by floor and sidewall soil sampling. Excavation soil samples will be analyzed on-site for pH and off-site for total organic carbon (TOC). Fingerprinting work conducted by SECOR indicates that the acid sludge materials can be identified by pH levels below 3 and TOC concentrations greater than 100,000 mg/kg.

Once all acid sludge has been visually removed from an excavated off-site area, two soil samples will be collected for pH and TOC analyses to confirm that soil pH values are greater than 3 and TOC concentrations are less than 100,000 mg/kg. One floor and one sidewall sample will be collected from the midpoint of each excavated area, with a minimum of one floor and sidewall sample every 200 feet of off-site excavation.

Excavated waste layer material will be transported to the mix area and will be neutralized with calcium carbonate and mixed with overburden soils. Neutralized sludge material will then be placed and compacted within the footprint of the cap. The following sections address the specific neutralization activities in greater detail.

### **2.1.1.1 Excavation Activities**

Excavation activities during full-scale neutralization operations will generally move from west to east across the Site, with the exception of variations required to facilitate material handling. The oversight engineer will observe excavation operations and note the relative depths/volumes of varying materials encountered, along with their general location according to the 50-foot grid system that has been established at the Site.

Excavation will extend to the interface of the waste layer and the silty sand layer that underlies the Site. As much as ten feet of overlying material may be excavated to expose the waste layer, which has an average thickness of approximately five feet, based on information presented in the October 1988 Remedial Investigation Report, the April 1989 Feasibility Study Report, and recent test pit and pilot study excavations. Therefore, the excavation depths may extend as deep as 15 feet below the current Site surface to reach the bottom of the waste layer. Excavations will not extend into the silty sand underlying the waste layer (with the exception of what is necessary to remove the sludge).

The depth limits of excavation will be determined by the oversight engineer, who will visually inspect the excavation to confirm all sludge within the excavation has been removed and the silty sand layer is exposed across the entire excavation floor. Excavated materials may be segregated and stockpiled as necessary to facilitate material handling and neutralization activities.

If excavations extend to the side slopes, the toe of the side slope will be "keyed in" to an approximate depth of two feet below ground surface (bgs) around the Site perimeter. The exact "key in" depth will be determined by the soil conditions encountered during excavation, but will extend at least two feet bgs, or until the sludge materials are removed, whichever is greater. Neutralized materials will be placed and compacted from the bottom of the "key in" to the existing ground surface, and the side slope will be constructed from the ground surface to the top of the slope.

### **2.1.1.2 Well Abandonment Activities**

Wells used as part of the groundwater monitoring program will be left in place and protected to the extent possible during excavation activities. Wells to remain in place will include the following: MW-3, MW-5s, MW-5d, MW-6s, MW-6d, MW-7s, MW-7i, MW-8, Mw-14s, MW-14d, MW-16, EW-1, and EW-2. In the event a well used as part of the current groundwater monitoring program is damaged or destroyed during the neutralization activities, it will be repaired, or decommissioned and/or replaced according to California regulations.

All unused wells and structures located within the footprint of the Site will be properly abandoned, as detailed in SECOR's June 25, 2003 letter to USEPA. To summarize this correspondence, the wells to be abandoned were installed as part of various investigations and pilot studies over the past twenty years and are no longer used. A majority of the wells were constructed of ½-inch diameter PVC pipe and were installed with no protective casing below the ground surface. Protection of these wells will be impractical during the full-scale neutralization activities. All well abandonment activities will be conducted in accordance with Fresno County Health Service Agency requirements, and conform with the provisions of the California Department of Water Resources Bulletin 74-90, Part III, Section 19, which states that monitoring wells be abandoned by completely filling the well casing with sealing material (grout). The Fresno County Health Service Agency requires a completed permit application for each monitoring well to be abandoned. This permit application must include the abandonment contractor's name and active C-57 water well driller's license. Copies of all well abandonment permits will be provided to USEPA upon completion.

### **2.1.1.3 Ex-Situ Neutralization Activities**

Due to the heterogeneity of the sludge materials at the Site, field titrations will be performed to optimize reagent dosage. Prior to initial mixing of the calcium carbonate and sludge, a sample of the sludge will be collected from each batch for an on-site laboratory titration with sodium hydroxide to evaluate the sludge's acidity. The volume of each batch will be pre-determined and verified by survey and laser level. Batch sizes may vary due to traffic and other logistical constraints. The total weight of waste layer materials in each batch will be calculated by multiplying the surveyed volume by the site-wide average sludge density of 85 pounds per cubic foot. The total mass of calcium carbonate required will be calculated by multiplying the mass of sludge by the percent acidity and then multiplying by a factor of 1.25 to convert sodium hydroxide demand to calcium carbonate demand. This number will then be increased by a factor of safety of 30 percent to assure effective neutralization.

While these calculations are being performed, the equipment operators will begin applying a minimum dose (five percent by weight) of calcium carbonate to the sludge, to minimize the potential for sulfur dioxide emissions. The on-site laboratory titrations and demand calculations can be completed in approximately one half hour. When the on-site laboratory testing is complete, any additional calcium carbonate required for neutralization will be spread evenly and mixed with the waste layer material.

Initial bench scale testing (Appendix B) indicated that the "worst case" sludge with the highest acidity requires a calcium carbonate dosage ranging from 30 to 40 percent by weight. However, during pilot test operations, no sludge was encountered that required more than 30 percent calcium carbonate addition, while the majority of batches required less than 15 percent addition. The calcium carbonate demand for each neutralization batch is anticipated to range from 5 to 30 percent by weight, with an average demand of approximately 15 to 20 percent.

The wetted calcium carbonate fines will be delivered to the Site by tandem haul trucks and the material will be staged on Site. Volumes of calcium carbonate delivered and used will be logged and tabulated. Water will be added as necessary during dumping to reduce dusting, although the particle size of the carbonate fines is large enough to minimize dusting even without water. The amount of calcium carbonate needed will depend upon the percentages used during neutralization to achieve the desired goals, however, between two to five truckloads per day are anticipated.

The oversight engineer will record and document all mixture recipes, including calcium carbonate, soil, and waste layer material in each neutralization batch. The wetted calcium carbonate will be added to the sludge shortly after it is excavated, to expedite neutralization reactions and assist in scrubbing of residual sulfur dioxide that might be entrained in the sludge.

Previous excavations into the sludge have indicated the release of sulfur dioxide gas will be *de minimis*. For example, on July 9, 2002, five test pit excavations were completed to approximately 15 feet below grade to investigate the sludge at various Site locations. During excavation, no increases in sulfur dioxide concentrations were observed in the construction breathing zone. A sulfur dioxide meter was therefore lowered into the pits to record the worst-case sulfur dioxide concentrations at the pit bottoms (not an exposure zone), where the heavier sulfur dioxide gases accumulate. The peak instantaneous sulfur dioxide concentrations in the bottoms of the first three pits ranged from 0.1 to 0.2 ppmv. The peak instantaneous sulfur dioxide concentrations in the fourth pit bottom ranged from 4.1 to 5.7 ppmv, and the concentrations in the fifth pit bottom ranged from 0.3 to 1.0 ppmv. Where sulfur dioxide gases were observed in the pit bottoms, the TWA concentrations were below OSHA PELs, and no increase in sulfur dioxide concentrations were observed in the breathing zone around the pit surface.

Air monitoring conducted during the pilot study confirms that no significant releases of sulfur dioxide gas will occur. During the nine-week pilot study, occasional peaks of sulfur dioxide were detected in the construction breathing zone. These peaks occurred during excavation of materials from the waste layer, rather than during neutralization mixing activities. The instantaneous peaks, which were detected at locations adjacent to the excavation, were observed for less than one minute, and upgrades to Level C personal protective equipment (PPE) were not required. Sulfur dioxide was not detected in any of the air samples collected at the Site perimeter.

The acidic sludge and associated materials from the waste layer will be excavated and mixed with calcium carbonate ex-situ until a somewhat homogeneous material is formed. Visual observation provides the best qualitative measurement of adequate mixing because the material gradually blends to appear like a dark, humic topsoil, which indicates complete mixing (when lesser amounts of sludge are present, the final mix will not appear as dark). However, samples tested for pH (as described in Section 2.2) will provide the quantitative indicator of adequate mixing (if a sample fails the pH test, additional dosing and mixing of calcium carbonate will be performed).

Additional overburden soils will be added to the neutralized sludge/soil and calcium carbonate mixture to create an overburden to waste layer ratio of at least 1:1. Initial bench scale testing of the "worst case" sludge indicated that a mix ratio of three parts overburden soil to one part sludge was necessary to achieve adequate strength properties for the neutralized material. However, as described in Section 1.4, multiple batches were mixed at ratios ranging from 1:1 to 3:1 without any deleterious results. Areas where the sludge appears to be more concentrated or less stable may be mixed at higher overburden ratios, at the discretion of the oversight engineer. Neutralization will be conducted in a designated area, with the excavator mixing the material until a consistent texture is observed and all components appear to be well mixed. At this time, the oversight engineer will conduct mixing performance monitoring (described in Section 2.2) and record the mixing duration.

Large debris encountered during mixing will be temporarily removed and then placed back into the excavation when the neutralized mixture of soil and sludge is placed and compacted. Large debris will be placed in lifts starting at the bottom of the excavation, with neutralized waste layer material placed over and around the debris pieces. The debris and neutralized waste material layer will then be compacted. All debris will be kept as far as possible from the perimeter slopes.

Curing times will be monitored and documented for each neutralized batch. Sludge depth variability will also be measured and recorded. Figure 1 shows a conceptual layout of the neutralization process.

Equipment for the sludge neutralization activities is anticipated to include the following;

- One excavator with toothed-drum mix head
- Two excavators with buckets
- One to two bulldozers
- One to two loaders
- Two to three off-road haul trucks
- One sheep's foot compactor
- Two water trucks
- Air monitoring stations
- Total station survey equipment
- Field measurement equipment for pH and soil testing
- Health and safety monitoring and decontamination equipment



### **2.1.2 Odor and Dust Control**

A water truck will be used to minimize dust during calcium carbonate delivery and placement, excavation and mixing, and any other activities where dust may be generated. Odor suppressant will be added to the water as necessary to mitigate exposure to odors by off-site receptors.

### **2.1.3 Surface Water Management**

Proper drainage will be maintained at all times during neutralization activities to prevent ponding of storm water. As neutralization continues, grading will be conducted to provide positive runoff from all work areas. Drainage will be controlled through the maintenance of the earthen berms and silt fencing already installed at the Site. Any areas where the surface water controls are damaged or destroyed will be repaired before leaving the Site each day.

### **2.1.4 Backfill and Compaction**

Previous attempts at monitoring in-place density produced unsatisfactory results due to the prevalence of debris and sludge materials. Since the larger pieces of debris would be segregated and the materials would be thoroughly mixed during neutralization activities, SECOR evaluated the possibility of density testing again. A description of the field density test evaluation is provided in Section 1.4. Though not specified in California regulations, field density testing will be performed on the compacted neutralized waste layer materials to assess the density achieved during implementation.

Initial bench scale testing indicated that the optimum water for the neutralized "worst case" sludge was approximately 8 percent and significant deterioration of strength occurred past 11 percent. However, competent backfill mixes were compacted with water contents ranging from 7.5 to 14.6 percent during the pilot tests. The presence of soil within the waste layer and the minimal occurrence of "worst case" sludge materials provide neutralized batches that are much less sensitive to water content than originally anticipated. To meet the density parameters modeled in the slope stability analysis, neutralized waste layer materials will be compacted to a minimum wet density of 107 pcf and water content will be managed in the optimum range of 7 to 13 percent (10 percent plus or minus 3 percent). SECOR will backfill excavated areas using neutralized waste material that has passed the performance monitoring tests described above. Backfill will be placed in 12-inch thick, horizontal lifts and compacted.

Field density tests will be taken from compacted lifts with a drive cylinder. Small debris (less than two-feet in diameter) will still be present in the neutralized waste material, and may prohibit successful density testing under some conditions. Drive cylinder samples will be collected for each horizontal lift immediately after it is placed and compacted. Due to the geometrical constraints of the Site, lift dimensions may be variable, depending on other construction activities that are underway. Additional lifts will not be placed until a density test for the current lift has verified that the compaction goal has been met. Due to the presence of debris, individual lifts may vary in thickness from 10 to 12 inches after the sheep's foot roller has compacted them.

To provide the most conservative QA/QC data, the bottom portion of each lift will be sampled for density testing. A bulldozer will scrape off the top two to three tenths of each lift and the sample cylinder will be driven below the exposed surface to extract a density sample from the bottom half of the compacted lift. Should any density test fail due to the presence of debris in the subsurface, a second test will be taken adjacent to the first to confirm that the backfill has been compacted adequately. Lifts that do not meet the compaction requirement will be reworked and tested again. If the oversight engineer determines that the material is not capable of achieving the density specification, the lift will be removed and replaced with competent material. All drive cylinder test locations will be surveyed for confirmation of testing frequency. This testing will ensure that the backfill material has been thoroughly mixed in correct proportions to provide stable support for an overlying cap.

### **2.1.5 Grading**

The neutralized waste layer material will be graded to contours consistent with the original grades (although uniformly higher due to the addition of soil and calcium carbonate). As mixing continues, grading will be conducted to allow positive runoff from all neutralization areas.

### **2.1.6 Final Capping**

Final capping of the neutralized waste material will be addressed in a forthcoming addendum to this RAWP. The addendum will detail the final cap procedures to complete the OU-2 soils remedy.

## **2.2 PERFORMANCE MONITORING AND DATA QUALITY OBJECTIVES**

### **2.2.1 Performance Monitoring**

Sampling and testing will be conducted on the neutralized waste layer material during the mixing process. Three random pH tests will be conducted after each batch has been mixed, to ensure proper neutralization and prevent overdosing. The results of these tests will be used to check and confirm the mixing process and to verify that performance parameters are met before placing neutralized waste material into stockpiles or compacting back into the cell.

Samples of the neutralized waste layer material will be tested in the field during mixing using a pH meter to provide real-time results on the effectiveness of the neutralization. Pilot and bench scale testing indicates that a real-time pH value of 4.0 or higher in the field is sufficient to achieve a final pH above 5.0. The final pH performance value of 5.0 has been selected based on bicarbonate equilibrium limitations and solubility charts for lead carbonates. Water at pH 5.0 contains only 0.01 mg/l of  $H^+$  and is only mildly acidic, and hydrocarbon oxidation reactions that create sulfur dioxide gas will not occur at this pH value. When field pH testing indicates the performance standards have been achieved (pH greater than 4.0), samples of the treated material will be tested after one hour of curing time for confirmation pH testing.

Three samples of neutralized waste material will be collected from each batch for pH testing to assure the final pH of the mixture is at or above 5.0. Grab samples are appropriate for pH testing, since the mixed material will actually be a composite material. If the pH samples do not pass the quality assurance criteria of 5.0, additional reagent will be added to the material and proportionally mixed prior to resampling. The material will be considered neutralized when all three samples pass the pH criteria.

Testing will be performed on-site in accordance with SW846 EPA Method 9045C, Section 7.2. This procedure involves placing 20 grams of material into a beaker with 20 milliliters of de-ionized water. The sample used for testing should react for at least one hour prior to pH testing to maximize the loss of carbon dioxide for minimal interference by carbonic acid. Water is then added to the sample and the sample is mixed with a stir-bar or mechanical mixer for five minutes. Initial readings may be taken after five minutes to provide an indication of the final pH. The sample is then allowed to stand for one hour to allow the majority of solids to settle. The pH of the clear supernatant solution is then measured. Additional dilutions may be used if an insufficient amount of supernatant fluid is formed due to water uptake by calcium carbonate salts. Pilot and bench-scale testing shows that the pH results from EPA Method 9045C are representative of the pH obtained on the materials after 24 hours of cure time (see Appendix B).

### 2.2.2 Data Quality Objectives

Data quality objectives (DQOs) have been developed for the neutralization activities. The table below summarizes the various tests proposed, the desired performance, and the decision criteria used to measure performance.

#### Neutralized Waste Layer Materials

Test	Desired Performance	Decision Criteria
Field pH	4.0 or greater	<4.0 requires additional neutralization/mixing
One-hour pH	5.0 or greater	<5.0 requires additional neutralization/mixing
Field Density Testing	Consistent results in neutralized waste layer with water content 7-13% and wet density >107 pcf	Incorporate effective test method(s) for full-scale CQA if results are consistent, continue compaction effort until wet density criteria is met

## 2.3 AIR MONITORING AND SAMPLING

Real-time air monitoring will be conducted in the construction (breathing) zone during neutralization to ensure worker safety during construction activities. If concentrations in the construction (breathing) zone deem it necessary, real-time air monitoring will also be conducted at the downwind Site perimeter to ensure work activities do not impact neighboring properties. Real-time data will be used to direct work activities and halt work as necessary to protect workers and off-site receptors.

Air sampling will be conducted at the Site perimeter to evaluate the potential air impacts associated with sludge neutralization activities. The air sampling activities will be conducted to verify the effectiveness of the real-time air monitoring program, as well as to evaluate and modify (as necessary) the BMPs implemented during construction activities. The air sampling program described below has been developed using the data collected during the nine-week pilot neutralization study.

During neutralization activities, a health and safety officer will be present to conduct real-time air monitoring and perimeter air sampling. If necessary, additional personnel may assist with the monitoring and/or sampling, provided they are properly trained by the health and safety officer.

### **2.3.1 Real-Time Air Monitoring**

Real-time air monitoring will be conducted during excavation and mixing activities. Air monitoring will be conducted in the breathing (construction work) zone and the downwind Site perimeter as necessary. Breathing zone monitoring will be conducted every 15 minutes (four times per hour), at a minimum. Real-time air monitoring will be conducted for the following parameters:

- PM10
- VOCs
- Trichloroethene and benzene (as necessary)
- Sulfur dioxide and hydrogen sulfide (also LEL, CO, OXY)

#### ***Respirable Particulates***

Real-time concentrations of respirable particulates, or particulates less than 10 microns in diameter, will be monitored using a portable real-time aerosol monitor (such as the ThermoMIE personalDataRAM, pDR-1000AN, or equivalent). The instrument will be calibrated, maintained, and operated in accordance with the manufacturer's instructions.

#### ***VOCs***

Real-time concentrations of VOCs will be monitored using a photoionization detector (PID), such as the ToxiRAE PID, PGM-30, or equivalent. The PID will be equipped with a 10.6 eV lamp, which is the appropriate lamp size for trichloroethene and benzene (both constituents detected in soil at the Site). The PID will be calibrated, maintained, and operated in accordance with the manufacturer's instructions.

Since a PID measures the total concentration of organic vapors rather than specific VOCs, colorimetric detector tubes (i.e., Drager) will be used to identify specific compounds. Colorimetric detector tubes for benzene and trichloroethene will be used, as necessary, if VOC concentrations are detected.

#### ***Hydrogen Sulfide and Sulfur Dioxide***

Real-time concentrations of hydrogen sulfide and sulfur dioxide will be monitored using a portable multi-gas monitor (such as RAE Systems VRAE-7800 or equivalent). The multi-gas monitor will be calibrated, maintained, and operated in accordance with the manufacturer's instructions.

### **2.3.1.1 Real-Time Air Monitoring Action Levels**

Real-time air monitoring action levels are summarized in Tables 1 and 2. Table 1 presents the action levels in relation to PPE requirements for on-site workers. Table 2 presents a summary of published exposure limits and real-time air monitoring response action levels.

The real-time project response levels are intended to initiate various activities that must be implemented to protect off-site receptors as well as the on-site workers. Response Level 1 is dependent upon air monitoring results obtained in the construction zone. If these concentrations are observed, increased surveillance of the real-time instruments in the construction zone will be conducted. If VOCs are detected with the PID above Level 1, Drager tubes will be used to determine the presence or absence of trichloroethene and benzene.

Response Level 2 is also dependent upon air monitoring results measured in the construction (breathing) zone. If Level 2 concentrations are observed, increased emission controls must be implemented and real-time monitoring must be conducted at the Site perimeter (in the nearest location downwind of construction activities). Monitoring at the Site perimeter will be conducted, at a minimum, once every 15 minutes when Level 2 concentrations are observed in the breathing zone.

Response Level 3 is dependent upon air monitoring results measured at the Site perimeter. If Level 3 concentrations are measured and sustained for 30 consecutive minutes at the Site perimeter, work activities will be temporarily suspended. Additional emission controls/BMPs will be implemented in the construction zone, and work activities will resume once real-time air monitoring results below Level 3 are sustained at the Site perimeter for 15 minutes.

### **2.3.1.2 Real-Time Air Monitoring Documentation**

Real-time monitoring will be documented on the Real-Time Air Monitoring Logs, included in Appendix H. Separate forms will be used for construction zone monitoring and perimeter monitoring. Field activities requiring real-time monitoring will be documented on the Field Activity Daily Logs, included in Appendix H.

All real-time monitoring instruments will be programmed to record monitoring data during construction activities. The instrument data will be downloaded to a personal computer and all data will be printed and maintained on-site.

Weekly summaries of real-time air monitoring data will be submitted to USEPA, and will include the summary pages for the downloaded instrument data. Detailed printouts of the instrument data will be available on-site and shall be provided upon request.

### **2.3.2 Air Sampling**

Air sampling will be conducted during excavation and mixing activities. Air samples will be collected at sampling stations situated at locations on the Site perimeter, including a location in the northeast portion of the Site near the Golden State Market, as requested by USEPA. Samples will be laboratory-analyzed for the following parameters:

- Total suspended particulates (TSP)
- Lead (from TSP filters)
- VOCs
- Sulfur compounds

TSP and lead will be sampled at four locations (S1, S2, S5, S6) surrounding the Site. VOCs and sulfur compounds will be sampled at two locations, one based on the predominant wind direction (S5) and the other near the Golden State Market (S6). Sampling stations are shown on Figure 3.

Since the nine-week neutralization pilot test activities and data analysis have shown no significant air quality impacts as a result of neutralization activities, the frequency of sampling during full-scale neutralization will be such that samples will be collected one day per week. The sampling will be conducted to verify neutralization activities continue not to cause significant air quality impacts. The sample day will be selected at random, unless real-time air monitoring or other condition indicates potential for impacting air quality exists. Furthermore, if real-time air monitoring and/or other conditions (such as a nuisance complaint) indicate potential for impacting air quality exists, additional samples may be collected. Table 3 summarizes the air sampling plan for full-scale neutralization.

#### ***TSP and Lead***

TSP will be sampled using high-volume volumetric flow-controlled samplers, in accordance with USEPA Inorganic Compendium Method IO-2.1, Sampling of Ambient Air for Total Suspended Particulates Matter (SPM) and PM10 Using High Volume (HV) Sampler (June 1999, EPA/625/R-96/010a). The TSP filters will be analyzed for lead according to 40 CFR Part 50. Samples will be collected over 24-hour sample periods (morning to morning).

#### ***VOCs***

VOCs will be sampled using cleaned, evacuated SUMMA polished stainless steel canisters. Sampling and analysis of VOCs will be conducted in accordance with USEPA Toxic Organic Compendium Method TO-14A, Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using Specially Prepared Canisters with Subsequent Analysis by Gas Chromatography (January 1999, EPA/625/R-96/010b). Integrated samples for VOC analysis will be collected over 12-hour time periods. The sample time period may be adjusted such that it is consistent with construction work activity timeframes.

#### ***Sulfur Compounds***

Sulfur compounds will be sampled using gas sampling bags (i.e., Tedlar), as requested by USEPA, and lung samplers (sample bag container and pump). Samples will be analyzed using ASTM D5504. Samples will be collected for analysis of sulfur compounds over 12-hour periods. The sample time period may be adjusted such that it is consistent with construction work activity timeframes.

### **2.3.2.1 Background Sampling**

Five days of background sampling will be conducted to evaluate ambient concentrations of airborne chemicals. To obtain background data for timeframes similar to those in which construction activities will be conducted, background samples will be collected during weekdays, rather than on weekends, since construction work activities will primarily be conducted on weekdays. Samples will be collected and analyzed according to the methods and sampling times specified above.

### **2.3.2.2 Laboratory Procedures**

During neutralization activities, sulfur samples will be submitted to the laboratory on the day they are collected due to the 24 to 48 hour hold times. VOC samples will also be submitted to the laboratory on the day of collection. If it is not possible to ship a sample the day of collection, the sample will be shipped the following day (provided sample holding times are met). TSP and lead samples will be shipped to the laboratory on a weekly basis.

A standard turnaround time (TAT), 14 to 21 days, will be requested for all analyses. However, if conditions in the field such as nuisance complaints or unexpected sustained real-time monitoring results warrant expedited analysis, samples will be submitted to the laboratory on the day of collection and a quick turn protocol will be requested.

### **2.3.2.3 Air Sampling Documentation and Data Collection**

All sampling activities will be recorded in the field on air sampling field logs, and collected information will be transferred to electronic forms for use in determining the sample volumes. For TSP and lead, the field data collected will be used to calculate the volumes of air sampled over the 24-hour period. Upon receipt from the laboratory, the analytical results for TSP and lead (in units of mass) will be divided by the volume of air sampled (in cubic meters) to obtain the actual concentrations.

### **2.3.2.4 Air Sampling Action Levels**

Draft Risk-Based Trigger Concentrations in Air for Off-Site Exposure Locations were provided by USEPA on March 11, 2003. These values will be used as air sampling action levels for the neutralization activities. An exceedance of these action levels will trigger increased surveillance of real-time monitoring and evaluation and modification (as necessary) to in-place BMPs.

In addition to the Tier I levels developed by USEPA, Tier II and Tier III air sampling action levels were developed and will be implemented during neutralization. Tier II action levels are the lower of the following values:

- Carcinogenic risk-based standards calculated using  $10^{-5}$  risk; or
- OSHA PELs, adjusted for a 12-hour exposure, with an additional safety factor.

Exceeding a Tier II action level will trigger additions to in-place BMPs, such as adding vapor-suppressant foam or additional dust control practices, etc.

Tier III action levels will be the lower value of the following values:

- Carcinogenic risk-based standards calculated using  $10^{-4}$  risk; or
- OSHA PELs, adjusted to account for a 168-hour exposure (7 days/week, 24 hours/day).

Exceeding a Tier III action level will trigger stopping work and evaluating all procedures, until it is determined work can resume without exceeding Tier III levels. The tiered TCs are presented on Table 4.

## 2.4 OFF-SITE PROPERTIES

The sludge originating from the Site will be excavated, even if the sludge extends onto off-site properties (Tall Trees Mobile Home Park, Bruno's Recycling, Golden State Market, and Pick-A-Part Auto Sales), taking into consideration structures or other physical limitations. The extent of off-site waste layer excavation will be visually determined by the oversight engineer, and will be confirmed as necessary by floor and sidewall soil sampling. Excavation soil samples will be analyzed on-site for pH and off-site for TOC. Fingerprinting indicates that the acid sludge can be identified by pH levels below 3 and TOC concentrations greater than 100,000 mg/kg.

Once the sludge has been visually removed from an excavated off-site area, two soil samples will be collected for pH and TOC analyses to confirm that soil pH values are greater than 3 and TOC concentrations are less than 100,000 mg/kg. One floor and one sidewall sample will be collected from the midpoint of each excavated area, with a minimum of one floor and sidewall sample every 200 feet of off-site excavation. This approach will ensure the Purity sludge is excavated from off-site properties.

To evaluate potential off-site impacts from the Site, historical off-site soil data from each of the four neighboring properties have been compared to the USEPA Region IX PRGs as follows:

- Carcinogenic compounds were screened against the Region IX PRGs ( $1 \times 10^{-6}$  risk); and
- Noncarcinogenic compounds were screened against the Region IX PRGs  $\times 0.1$  (to account for potential cumulative effects).

These conservative comparisons were conducted for both residential and industrial land use scenarios. The screens indicated lead is the primary chemical of concern for both land use scenarios. However, the PRG for lead is a noncarcinogenic CalEPA modified value specified for residential land use. An industrial land use PRG is not available, so the residential value was used for both comparisons. The screens also indicated the majority of samples with the highest lead concentrations were located within the estimated sludge footprint.

Therefore, for properties (or portions of) where sludge is not present or has been excavated and neutralized, an evaluation will be conducted to determine if potential impacts from the Site exist, and if so, a risk evaluation will be conducted. If the risk evaluation determines the property exceeds the applicable criteria, the property will be made protective of human health and the environment through the implementation of specific-use restrictions. The off-site risk evaluation procedures will be defined in the RAWP addendum.



### 3.0 SCHEDULE

Figure 4 presents the estimated schedule for implementing the neutralization program outlined in this document. The schedule defines the estimated duration for each of the critical path items. This schedule is contingent upon the neutralization program being implemented as defined herein. Changes to the proposed methods and procedures will impact the project schedule. While the schedule assumes a start date of October 27, 2003, the actual schedule will be tied to the date USEPA provides final approval for the modified remedy.

**APPENDIX B**  
**BENCH SCALE TESTING SUMMARY**

**SUMMARY OF BENCH SCALE SOLIDIFICATION AND  
NEUTRALIZATION TESTING ON SULFONATED SLUDGE  
AT THE PURITY OIL SITE, FRESNO, CALIFORNIA**

October 11, 2002

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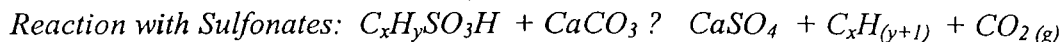
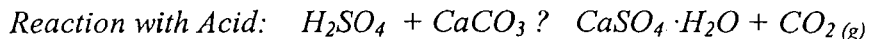
## EXECUTIVE SUMMARY

Bench scale tests were performed to evaluate stabilization and neutralization of sludge from the Purity Oil site in three different testing phases. The first testing (Phase I Bench Scale Testing) was performed on April 22, 2002 to demonstrate the effectiveness of quicklime as a stabilization reagent for the sulfonated sludge. Subsequent testing was performed on July 2 and July 3, 2002 (Phase II Bench Scale Testing) to further evaluate the use of portland cement, calcium carbonate, and quicklime as neutralization and solidification reagents. The results of this testing showed that quicklime was the superior of the three reagents with respect to strength and neutralization capacity, but calcium carbonate or portland cement could be used for solidification if the sludge was mixed with three parts soil by weight during treatment.

After reviewing the bench scale treatability reports, the USEPA stated it preferred calcium carbonate as the treatment reagent for the Site. Therefore, additional testing (Phase III Bench Scale Testing) was performed to identify calcium carbonate mixing ratios and density/moisture relationships for the treated sludge-soil mixture to optimize neutralization activities in the field. The results of the Phase III Bench Scale Testing are summarized in this report.

## 1.0 INTRODUCTION

Neutralization of acidic sludge with calcium carbonate is accomplished when the calcium carbonate reacts with residual sulfuric acid and sulfonated functional groups in the tarry sludge to convert sulfate acidity into calcium sulfate via the following reactions:



The neutralization reactions create a mixture of calcium sulfate and tar. The reaction requires a large amount of calcium carbonate surface area and sufficient moisture to proceed. The water content in the sludge (20 percent by weight) is generally sufficient to drive the reaction with only minimal addition of water. Calcium carbonate fines in the size range of 16 to 200 mesh have a large surface area, but they are also large enough to create minimal dust during use. The testing described in this report was performed to answer the following questions for field implementation of calcium carbonate neutralization:

1. How much water can be added to the soils and sludge during neutralization before the material becomes too soft for effective compaction?
2. How much time is required for the neutralization reaction to proceed using a 16 to 200 mesh calcium carbonate material when operating in the ideal moisture range?

The dosage requirements for calcium carbonate are dependant upon the type of sludge being neutralized. The filter cake sludge observed across much of the Site has a low acidity that typically requires less than ten percent calcium carbonate by weight for neutralization. The soft tar observed in the western portion of the Site has a much higher acidity and requires between 30 to 40 percent calcium carbonate by weight for neutralization. The sludge with the higher acidity requires more time to achieve neutral pH values, due to associated carbon dioxide/bicarbonate equilibria. In addition, this tarry sludge is more difficult to solidify than the filter cake material. Therefore, neutralization testing with calcium carbonate was evaluated as a function of time on the more acidic, tarry sludge. The results of the testing are described in the following sections.

## 2.0 DETERMINING THE WORKABLE MOISTURE CONTENT RANGE

When one part sludge and three parts soil are mixed together during treatment, the resulting material has a moisture content ranging from seven to eight percent by weight. Water will be added to the mixture by the addition of wet carbonate fines and water as a dust suppressant. Testing was performed to determine the workable moisture content range of the soil/sludge mixture to assure the material is not over-wetted in the field.

Treated material that is saturated with water will have insufficient strength properties for placement and compaction after treatment.

## **2.1 Procedure**

Two neutralized samples of a soil/sludge mixture were prepared in the laboratory by mixing 300 grams of sludge with 900 grams of soil and adding calcium carbonate to the samples for neutralization. The calcium carbonate was added to the samples using two different methods. One sample was prepared using dry calcium carbonate fines and the second sample was prepared using a calcium carbonate slurry.

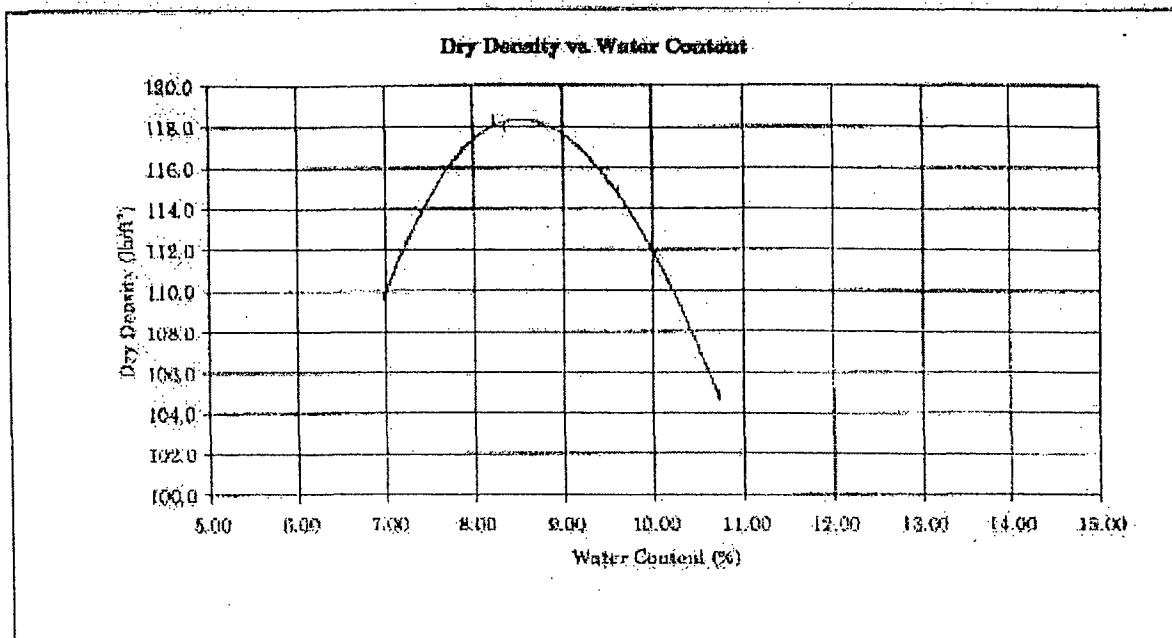
The first sample was prepared by adding 108 grams of dry calcium carbonate fines in the size range of 16 to 200 mesh to the 1,200-gram soil/sludge mixture. The soil, sludge, and calcium carbonate were then mixed using a stainless steel bowl and spatula until a uniform consistency was achieved. The material was then placed into one-liter jars for subsequent testing of the moisture/density properties at SECOR's geotechnical laboratory.

The calcium carbonate for the second sample was prepared by mixing 180 grams of powdered calcium carbonate with water to create a 30-percent slurry. This slurry was then combined with 300 grams of sludge and 900 grams of soil for mixing following the same procedure as the first sample. The resulting material was noted to be fluid-like in appearance and underwent volume expansion as carbon dioxide was produced and entrapped within the liquid matrix. The sample was allowed to react for one hour prior to placing the material into sample jars for subsequent testing.

## **2.2 Results**

The treated sample prepared with the calcium carbonate slurry was very wet and fluid-like and was noted to contain free liquid. The material was not compactable, so geotechnical testing was limited to testing of water content and density. Testing of the mix yielded an average water content of 54 percent and an average dry density of 50 pounds per cubic foot.

The sample prepared with dry calcium carbonate fines was comprised of a moist, grey silty sand mixed with sludge and calcium carbonate and trace gravel. Testing indicated that the initial water content of the sample was approximately seven percent. Moderate compactive effort yielded an average dry density of 108 pounds per cubic foot. The Modified Proctor Compaction Test indicated that the maximum dry density for the sample was 118.4 pounds per cubic foot at 8.4 percent water content. The results indicated that the dry density would fall below 100 pounds per cubic foot if the water content exceeded 11 percent. Therefore, 11 percent represents the upper limit of moisture the sample should contain after treatment. The results of the density/moisture testing are shown graphically on the following page.



### 3.0 DETERMINING CALCIUM CARBONATE REACTION TIMES

Calcium carbonate reacts quickly with acids at pH values less than 4.0. However, the reaction slows thereafter due to the bicarbonate equilibria, which buffer the system. Bicarbonate buffered systems will resist changes in pH from acids or bases. Aqueous changes in the bicarbonate chemistry may produce changes in the pH in a matter of hours or days, while changes from carbon dioxide partial pressure equilibration occur over longer periods of time. Bench scale testing was therefore performed to determine the amount of reaction time required for the calcium carbonate neutralization reactions to proceed before the pH performance standard of 5.0 or greater was achieved. The results of these studies are summarized below.

#### 3.1 Procedure

Bench scale testing was conducted to determine optimal calcium carbonate ( $\text{CaCO}_3$ ) addition rates for pH adjustment of the acidic sludge/soil matrix at the Site. The project objective was to achieve a pH above 5.0 for the final neutralized material. Six percentages of  $\text{CaCO}_3$  were evaluated during the testing. The material ratios for each mix are listed below.

Mix #1 (6.3%): 100g sludge/300g soil/28g  $\text{CaCO}_3$ /16g water

Mix #2 (7.1%): 100g sludge/300g soil/32g  $\text{CaCO}_3$ /16g water

Mix #3 (8.0%): 100g sludge/300g soil/36g  $\text{CaCO}_3$ /16g water

Mix #4 (8.9%): 100g sludge/300g soil/40g  $\text{CaCO}_3$ /16g water

Mix #5 (12.6%): 100g sludge/300g soil/60g CaCO<sub>3</sub>/16g water

Mix #6 (16.1%): 100g sludge/300g soil/80g CaCO<sub>3</sub>/16g water

The following steps were performed during sample preparation of each mix.

- 1) The soil and sludge were combined in a ziplock bag and kneaded/mixed until a uniform consistency was achieved.
- 2) The CaCO<sub>3</sub> was measured in a weigh dish and wetted with a water mass of 10% (w/w). Wetting the material in this manner gave the CaCO<sub>3</sub> a wet, granular sand consistency that was manageable for mixing.
- 3) The wetted CaCO<sub>3</sub> was added to the sludge/soil matrix and mixed until evenly dispersed. Carbon dioxide production was observed, as the ziplock bags inflated during sample mixing.
- 4) The carbon dioxide was released from the ziplock bags and additional water was added to simulate water addition in the field for dust control. A total of 16 grams of water were added to each sample through the addition of calcium carbonate moisture and supplemental water to generate a final material with 11 percent moisture content. Therefore, 13.2g, 12.8g, 12.4g, 12.0g, 10.0g, and 8.0g of water were added to Mixes #1, #2, #3, #4, #5, and #6, respectively.
- 5) The samples were mixed and allowed to react for a period of one hour. Carbon dioxide production was observed throughout the one-hour reaction time as partial inflation of the ziplock bags occurred.

Prior to sample monitoring, the calibration of the pH probe was checked against known laboratory standards. The results of this calibration check are presented below.

<u>Laboratory pH Standard</u>	<u>Measured pH Level</u>
4.0	4.01
7.0	7.01
10.0	10.02

Samples were collected and monitored for pH from the neutralized sludge-soil samples as a function of time during sample curing. The pH testing was performed using a Model 3+ pH Tester manufactured by Oakton Instruments. Twenty grams of material were combined with an equal mass of water and mixed for 5 minutes to obtain pH values of the soil/sludge mixture as a function of time. After one hour, a sample of the mixture was also collected and tested using the testing protocol outlined in EPA Method 9045C. The pH of the neutralized samples were measured and recorded as a function of time.



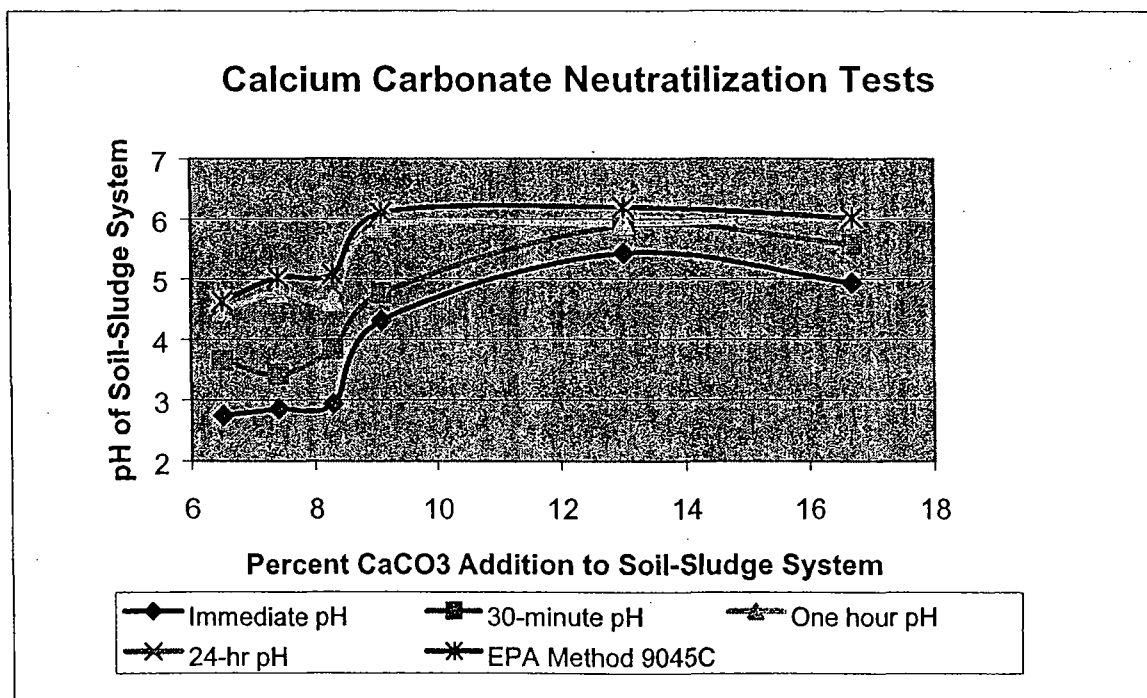
### 3.2 Results

The results of the pH monitoring during the calcium carbonate neutralization tests are summarized in the table below.

Percent CaCO <sub>3</sub> to Sludge (wt/wt)	Percent CaCO <sub>3</sub> to Mixture (wt/wt)	Immediate pH	30 minute PH	60 minute pH	24-hour pH	EPA Method 9045C
28	6.5	2.75	3.65	4.48	4.56	4.63
32	7.4	2.86	3.42	4.79	4.96	5.03
36	8.3	2.94	3.84	4.65	4.87	5.08
40	9.1	4.31	4.76	5.87	6.26	6.10
60	13	5.43	5.88	5.92	6.12	6.20
80	16.7	4.94	5.58	6.02	6.02	6.02

The testing indicates the more acidic sludge at the western portion of the site will require between 30 to 40 percent calcium carbonate addition by weight to neutralize the sludge acidity to a pH value that exceeds 5.0. Bicarbonate equilibrium reactions appear to cause rate limitations on the neutralization process, as calcium carbonate addition ratios greater than 40 percent resulted in a leveling off of post-treatment pH values.

Samples of the material were reserved for future testing to evaluate long-term pH effects on the material after mixing. The testing showed that the pH of the mixed material monitored after one hour of reaction time, using EPA Method 9045C, provided results that were similar to those recorded after 24 hours of cure time. Therefore, the EPA Method for measuring pH should provide an accurate assessment of the material pH. The results of the neutralization testing are summarized in graphical form below.



#### 4.0 CONCLUSIONS

The bench scale testing shows that calcium carbonate fines in the size range of 16 to 200 mesh may be used to successfully neutralize the acidic sludge at the Purity Oil site. Calcium carbonate fines in this size range provide high surface area to drive the reaction while minimizing dust problems due to the particle size. When the calcium carbonate fines were wetted with ten percent moisture, the fines had the physical appearance of a fine, wetted sand that was easily worked into the soil and sludge mixture.

Geotechnical testing showed that the neutralized soil-sludge mixture achieves its greatest density at a moisture content of approximately eight percent. Additional water may be added to the material during mixing for dust control, as long as the final moisture content does not exceed 11 percent. Ideally, the working range for moisture should be eight to ten percent.

Bench scale testing showed that a pH greater than 5.0 can be achieved after approximately one hour of reaction time. Testing for pH using EPA Method 9045C produced data that was very similar to the pH values obtained from the material after 24 hours of reaction. Therefore, this EPA Method for measuring pH in soils and waste materials is recommended for confirmation of performance standards. However, real-time pH measurements of the material should also be performed in the field to determine when a sufficient dosage of calcium carbonate has been added for treatment. Bench scale testing indicates that real-time pH values of 4.0 or greater stabilize to pH values greater than 5.0 over time. However, the relationship between real-time pH values and long term pH values of the neutralized material should be further evaluated during pilot scale testing.

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**DENSITY AND WATER CONTENT (ASTM D 2216, EM 1110-2)****Laboratory Data and Results**

Client/Project:	Chevron/Purity Oil
Job No.:	24CH.67001.00
Task:	0006
Sample ID:	SECOR Mix
Tested By:	TC
Date:	9/10/02

**Density and Water Content Analyses**

Sample Description: Grey silty sand with gravel and sludge, moist, disturbed

Sample Condition: Disturbed

**TRIAL 1**

Specific Gravity of Solids = 2.65

☐ Caliper Method:

Diameter (cm)	
Length (cm)	

☒ Volumeter Method:

Volume (cm <sup>3</sup> )	25.00
Tare Mass (g)	1.30
Wet + Tare (g)	46.97
Dry + Tare (g)	44.03

Water Content (%)	6.9
Porosity Estimate (%)	35.5

	(g/cm <sup>3</sup> )	(lb/ft <sup>3</sup> )
Natural Density	1.83	114
Dry Density	1.71	107

**TRIAL 2**

Specific Gravity of Solids = 2.65

☒ Caliper Method:

Diameter (cm)	3.51
Length (cm)	7.54

☐ Volumeter Method:

Volume (cm <sup>3</sup> )	
Tare Mass (g)	121.77
Wet + Tare (g)	259.29
Dry + Tare (g)	250.23

Water Content (%)	7.1
Porosity Estimate (%)	33.6

	(g/cm <sup>3</sup> )	(lb/ft <sup>3</sup> )
Natural Density	1.88	118
Dry Density	1.76	110

**TRIAL 3**

Specific Gravity of Solids =

☐ Caliper Method:

Diameter (cm)	
Length (cm)	

☐ Volumeter Method:

Volume (cm <sup>3</sup> )	
Tare Mass (g)	
Wet + Tare (g)	
Dry + Tare (g)	

Water Content (%)	
Porosity Estimate (%)	

	(g/cm <sup>3</sup> )	(lb/ft <sup>3</sup> )
Natural Density		
Dry Density		

**AVERAGE VALUES**

Water Content (%)	7.0
Porosity Estimate (%)	34.5

	(g/cm <sup>3</sup> )	(lb/ft <sup>3</sup> )
Natural Density	1.86	116
Dry Density	1.73	108

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## HYDRAULIC CONDUCTIVITY ANALYSIS

ASTM D 5084 (Method C)

Client/Project:	Chevron/Purity
Job No.:	24CH.67001.00
Task:	0006
Sample ID:	SECOR Mix
Tested By:	TC
Date:	9/25/02
Sample Condition: (Undisturbed or Remolded)	Undisturbed

### Sample Description:

Brown & grey silty sand with gravel, sludge, and CaCO<sub>3</sub>.

### Initial Sample Data:

Sample Length (cm)	7.14
Diameter (cm)	3.34
Mass of Sample (cm)	121.11
Area <sub>sample</sub> (cm <sup>2</sup> )	8.76

### Final Sample Data:

Sample Length (cm)	7.11
Diameter (cm)	3.33
Mass of Sample (g)	124.60
Area <sub>sample</sub> (cm <sup>2</sup> )	8.70

### Initial Water Content:

Tare (g)	4.44
Tare + Sample <sub>wet</sub> (g)	53.63
Tare + Sample <sub>dry</sub> (g)	49.19
w %	9.9

### Final Water Content Data:

Tare (g)	1.31
Tare + Sample <sub>wet</sub> (g)	125.91
Tare + Sample <sub>dry</sub> (g)	111.03
w %	13.6

### Initial Sample Density:

	g/cm <sup>3</sup>	lb/ft <sup>3</sup>
Wet Density	1.92	119.5
Dry Density	1.74	108.7

### Final Sample Density:

	g/cm <sup>3</sup>	lb/ft <sup>3</sup>
Wet Density	2.01	125.7
Dry Density	1.77	110.7

### Testing Conditions:

Cell Pressure (psi)	12.0
Total Backpressure (psi)	1.5
Max. Effective Stress (psi)	3.0
Min. Effective Stress (psi)	1.5
Applied Gradient	14.8
Permeant Liquid	H <sub>2</sub> O

### Results:

Hydraulic Conductivity (cm/sec)	5.6E-06
---------------------------------	---------

### Comments

Moisture conditioned to approximately 9% water content prior to testing. Disturbed sample was compacted to approximately 90% maximum dry density in Harvard Compaction Apparatus prior to placement in perm cell.

# HYDRAULIC CONDUCTIVITY FINAL REPORT DATA SHEET

ASTM D 5084 (Method C)

Client/Project:	Chevron/Purity
Job No.:	24CH.67001.00
Task:	0006
Sample ID:	SECOR Mix
Tested By:	TC
Date:	9/25/02
Sample Condition:	Undisturbed

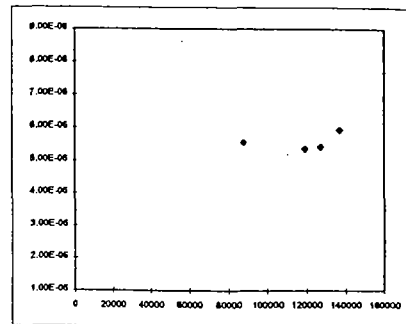
Sample Length (in)	2.82
Sample Diameter (in)	1.32
Mass Tare (g)	1.07
Mass Tare + Soil (g)	122.18
$\rho_{\text{wet}} (\text{g/cm}^3)$	1.92

Sample Length (in)	2.80
Sample Diameter (in)	1.31
Mass Tare (g)	1.31
Mass Tare + Soil (g)	125.91
$\rho_{\text{wet}} (\text{g/cm}^3)$	2.01

Length (in)	2.810
Diameter (in)	1.315
Area (cm <sup>2</sup> )	1.36
Area (in <sup>2</sup> )	0.906

Tare (g)	4.44
Tare + Sample <sub>wet</sub> (g)	53.63
Tare + Sample <sub>dry</sub> (g)	49.19
$e\%$	9.9

Tare (g)	1.31
Tare + Sample <sub>wet</sub> (g)	125.91
Tare + Sample <sub>dry</sub> (g)	111.03
$e\%$	13.6



<b>Initial Conditions</b> $P_{\text{atm}}$ 9.8 psi $P_{\text{upper}}$ 8.8 psi $P_{\text{lower}}$ 12.0 psi $P_h$ 70.4 cm H <sub>2</sub> O $i$ 9.9 <b>Final Conditions</b> $V_{\text{initial}}$ 24.35 cm <sup>3</sup> $V_{\text{final}}$ 0.50 cm <sup>3</sup> $h(t)$ 26.32 cm <b>Results</b> $t$ 10:40:00 or 38400 sec $K$ 7.84E-06 cm/sec	<b>Initial Conditions</b> $P_{\text{atm}}$ 10.5 psi $P_{\text{upper}}$ 9.0 psi $P_{\text{lower}}$ 12.0 psi $P_h$ 105.6 cm H <sub>2</sub> O $i$ 14.8 <b>Final Conditions</b> $V_{\text{initial}}$ 24.30 cm <sup>3</sup> $V_{\text{final}}$ 0.20 cm <sup>3</sup> $h(t)$ 26.60 cm <b>Results</b> $t$ 4:05:00 or 14700 sec $K$ 6.19E-06 cm/sec	<b>Initial Conditions</b> $P_{\text{atm}}$ 10.5 psi $P_{\text{upper}}$ 9.0 psi $P_{\text{lower}}$ 12.0 psi $P_h$ 105.6 cm H <sub>2</sub> O $i$ 14.8 <b>Final Conditions</b> $V_{\text{initial}}$ 24.65 cm <sup>3</sup> $V_{\text{final}}$ 0.15 cm <sup>3</sup> $h(t)$ 27.04 cm <b>Results</b> $t$ 2:15:00 or 8100 sec $K$ 5.43E-06 cm/sec
<b>Initial Conditions</b> $P_{\text{atm}}$ 10.5 psi $P_{\text{upper}}$ 9.0 psi $P_{\text{lower}}$ 12.0 psi $P_h$ 105.6 cm H <sub>2</sub> O $i$ 14.8 <b>Final Conditions</b> $V_{\text{initial}}$ 24.50 cm <sup>3</sup> $V_{\text{final}}$ 0.60 cm <sup>3</sup> $h(t)$ 26.38 cm <b>Results</b> $t$ 3:40:00 or 13200 sec $K$ 5.87E-06 cm/sec	<b>Initial Conditions</b> $P_{\text{atm}}$ 10.5 psi $P_{\text{upper}}$ 9.0 psi $P_{\text{lower}}$ 12.0 psi $P_h$ 105.6 cm H <sub>2</sub> O $i$ 14.8 <b>Final Conditions</b> $V_{\text{initial}}$ 11.35 cm <sup>3</sup> $V_{\text{final}}$ 13.40 cm <sup>3</sup> $h(t)$ -2.26 cm <b>Results</b> $t$ 2:42:00 or 9720 sec $K$ 5.56E-06 cm/sec	<b>Initial Conditions</b> $P_{\text{atm}}$ 10.5 psi $P_{\text{upper}}$ 9.0 psi $P_{\text{lower}}$ 12.0 psi $P_h$ 105.6 cm H <sub>2</sub> O $i$ 14.8 <b>Final Conditions</b> $V_{\text{initial}}$ 17.90 cm <sup>3</sup> $V_{\text{final}}$ 6.90 cm <sup>3</sup> $h(t)$ 12.14 cm <b>Results</b> $t$ 2:42:00 or 9720 sec $K$ 5.94E-06 cm/sec
<b>Initial Conditions</b> $P_{\text{atm}}$ 10.5 psi $P_{\text{upper}}$ 9.0 psi $P_{\text{lower}}$ 12.0 psi $P_h$ 105.6 cm H <sub>2</sub> O $i$ 14.8 <b>Final Conditions</b> $V_{\text{initial}}$ 13.45 cm <sup>3</sup> $V_{\text{final}}$ 12.20 cm <sup>3</sup> $h(t)$ 1.38 cm <b>Results</b> $t$ 3:15:00 or 11700 sec $K$ 5.95E-06 cm/sec	<b>Initial Conditions</b> $P_{\text{atm}}$ 10.5 psi $P_{\text{upper}}$ 9.0 psi $P_{\text{lower}}$ 12.0 psi $P_h$ 105.6 cm H <sub>2</sub> O $i$ 14.8 <b>Final Conditions</b> $V_{\text{initial}}$ 24.80 cm <sup>3</sup> $V_{\text{final}}$ 0.10 cm <sup>3</sup> $h(t)$ 27.26 cm <b>Results</b> $t$ 8:44:00 or 31440 sec $K$ 5.37E-06 cm/sec	<b>Initial Conditions</b> $P_{\text{atm}}$ 10.5 psi $P_{\text{upper}}$ 9.0 psi $P_{\text{lower}}$ 12.0 psi $P_h$ 105.6 cm H <sub>2</sub> O $i$ 14.8 <b>Final Conditions</b> $V_{\text{initial}}$ 3.00 cm <sup>3</sup> $V_{\text{final}}$ 22.50 cm <sup>3</sup> $h(t)$ -21.52 cm <b>Results</b> $t$ 0:00:00 or 0 sec $K$ #DIV/0! cm/sec

Trial 1	38400	7.84E-06	4.9E-06
Trial 2	14700	6.19E-06	1.8E-06
Trial 3	8100	5.43E-06	1.4E-06
Trial 4	13200	5.87E-06	1.4E-06
Trial 5	9720	5.56E-06	1.4E-06
Trial 6	9720	5.94E-06	1.4E-06
Trial 7	11700	5.95E-06	1.4E-06
Trial 8	31440	5.37E-06	1.4E-06
Trial 9	0	#DIV/0!	1.4E-06
Average		5.6E-06	1.4E-06

Range to meet ASTM	
Min	4.2E-06
Max	7.0E-06

Comments: Moisture conditioned to approximately 9% water content prior to testing. Disturbed sample was compacted to approximate

90% maximum dry density in Harvard Compaction Apparatus prior to placement in perm cell.

Soil Description: Brown & grey silty sand with gravel, silt, and CaCO<sub>3</sub>.

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## MOISTURE/DENSITY RELATIONS FOR GRANULAR SOILS (ASTM D 698)

Standard Compactive Effort Using 5.5 lb Hammer and 4" Mold

Client/Project:	Chevron/Purity Oil
Job No.:	24CH.67001.00
Task:	0006
Sample ID:	SECOR Mix
Tested By:	TC
Date:	9/10/02

### Soil Description:

Brown silty sand with gravel, sludge, and CaCO<sub>3</sub>.

### Standard Proctor Compaction Test

#### Initial Soil Data

Mass of Tare	1.43	grams
Mass of Soil + Tare	50.86	grams
Mass of Soil	46.95	grams
Mass of Water	3.91	grams
Initial Water Content	8.33	%

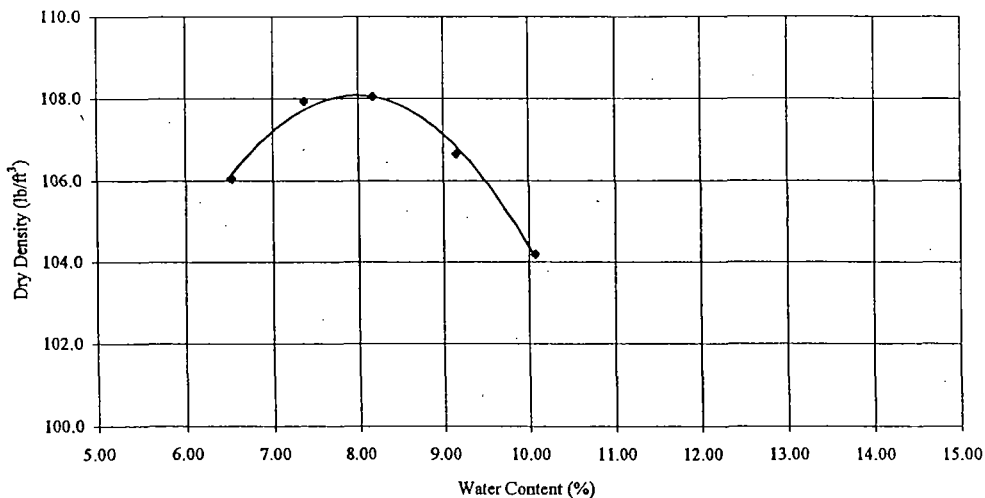
#### Compaction Mold Data

Mass of Mold	4616	grams
Volume of Mold	0.0009	m <sup>3</sup>

#### Compaction Data

Tare (g)	Water Added (%)	Mold & Material (grams)	Wet Material (grams)	Wet Density (Mg/m <sup>3</sup> )	Tare Mass (grams)	Tare Soil (grams)	Tare Soil (grams)	Actual (g)	Dry Density (Mg/m <sup>3</sup> )	Dry Density (lb/ft <sup>3</sup> )
6	0.0	6325	1709	1.81	1.30	59.24	55.69	6.53	1.70	106.0
7	25.0	6369	1753	1.86	1.31	45.20	42.19	7.36	1.73	107.9
8	25.0	6384	1768	1.87	1.29	44.56	41.29	8.18	1.73	108.0
9	25.0	6377	1761	1.87	1.30	46.87	43.05	9.15	1.71	106.6
10	25.0	6351	1735	1.84	1.31	48.61	44.28	10.08	1.67	104.2

Dry Density vs. Water Content



Maximum Dry Density	
(Mg/m <sup>3</sup> )	(lb/ft <sup>3</sup> )
1.73	108.1

Optimum Water Content (%)
8.0

### Comments:

# SECOR

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## MOISTURE/DENSITY RELATIONS FOR COARSE-GRAINED SOILS (ASTM D 1557)

Modified Compactive Effort Using 10 lb Hammer and 4" Mold

Client/Project:	Chevron/Purity Oil
Job No.:	24CH.67001.00
Task:	0006
Sample ID:	SECOR Mix
Tested By:	TC
Date:	9/10/02

### Soil Description:

Brown silty sand with gravel, sludge, and CaCO<sub>3</sub>.

### Modified Proctor Compaction Test

#### Initial Soil Data

Mass of Tare	41.61	grams
Mass of Soil + Tare	109.32	grams
Mass of Soil	102.22	grams
Mass of Water	7.1	grams
Initial Water Content	6.95	%

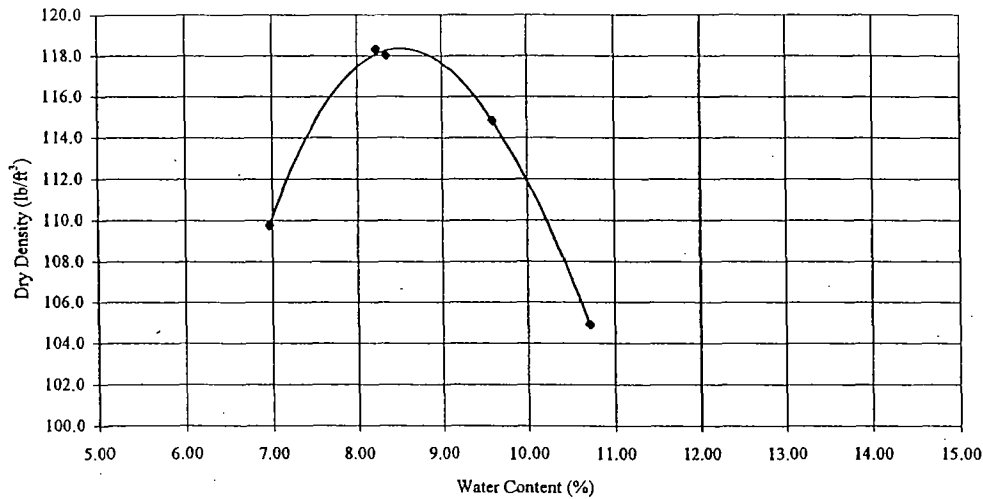
#### Compaction Mold Data

Mass of Mold	4594	grams
Volume of Mold	0.0009	m <sup>3</sup>

#### Compaction Data

Layer or Depth (ft)	Water Added (grams)	Mold & Material (grams)	Wet Material (grams)	Wet Density (Mg/m <sup>3</sup> )	Tare Mass (grams)	Tare - Soil (grams)	Tare - Soil (grams)	Airial (g)	Dry Density (Mg/m <sup>3</sup> )	Dry Density (lb/ft <sup>3</sup> )
7	0.0	6370	1776	1.88	4.39	138.57	129.83	6.97	1.76	109.7
11	90.0	6351	1757	1.86	4.40	133.05	120.60	10.71	1.68	104.9
9	0.0	6531	1937	2.05	4.35	119.07	110.35	8.23	1.90	118.3
8	0.0	6528	1934	2.05	4.39	95.80	88.76	8.34	1.89	118.0
10	50.0	6498	1904	2.02	4.35	105.44	96.58	9.61	1.84	114.8

Dry Density vs. Water Content



Maximum Dry Density	
(Mg/m <sup>3</sup> )	(lb/ft <sup>3</sup> )
1.90	118.4

Optimum Water Content (%)
8.4

### Comments:

# SECOR

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## UU TRI-AXIAL COMPRESSIVE STRENGTH - COHESIVE SOILS (ASTM D 2850)

### RESULTS

Client/Project:	Chevron/Purity
Job No.:	24CH.67001.00
Task:	0006
Sample ID:	SECOR Mix
Tested By:	TC
Date:	10/8/02

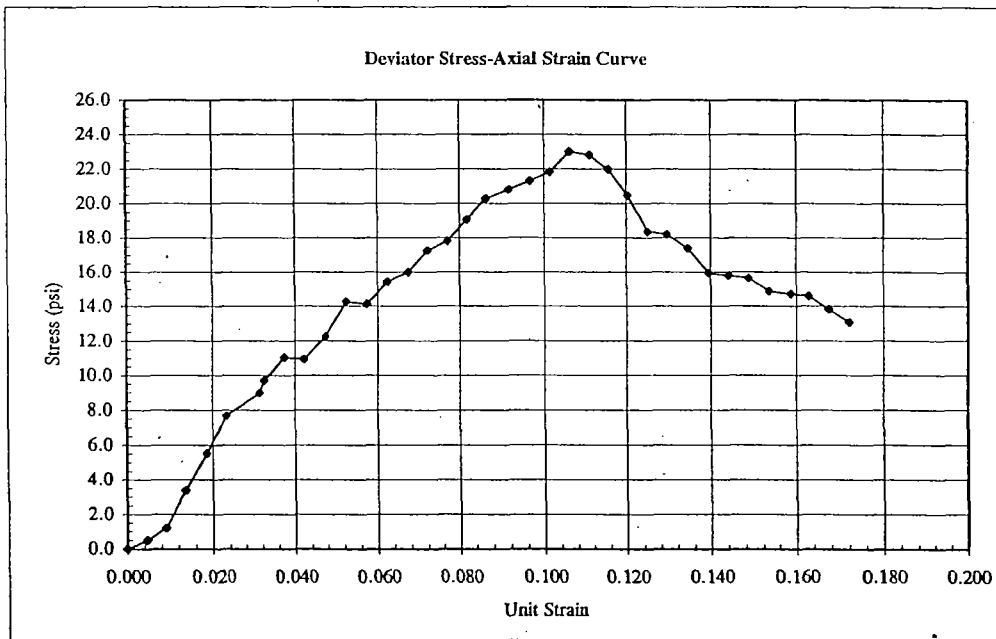
#### Initial Sample Data

Water Content	7.3 %	
	lb/ft <sup>3</sup>	Mg/m <sup>3</sup>
Bulk Density	129.1	2.1
Dry Density	120.3	1.9

#### Final Sample Data

Water Content	7.5 %
---------------	-------

Confining Stress: 10.0 psi



	lb/in <sup>2</sup>	lb/ft <sup>2</sup>	kN/m <sup>2</sup>
Normal Failure Stress, $\sigma_1$	23.0	3,312	159
Shear Failure Stress, $\sigma_3$	11.5	1,656	79
Undrained Modulus of Elasticity*, Es	575	82,800	3,964

\* Estimated using the secant method. Introduction to Geotechnical Engineering, Holtz, Robert D, and Kovacs, William D., p592, 1981.



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### LABORATORY DATA

Confining Pressure: 10.0 psi

Pore Water Pressure: 0.0 psi

### Test Data

### Initial Sample Properties

### Initial Water Content Data

### Final Water Content Data

Mass of Tare (g)	8.40
Mass of Sample <sub>Natural</sub> + Tare (g)	67.94
Mass of Sample <sub>Dry</sub> + Tare (g)	63.81
Mass of Sample <sub>Natural</sub> (g)	59.54
Mass of Sample <sub>Dry</sub> (g)	55.41
Mass of Water (g)	4.13

<b>Sample</b>	Grey silty sand with sludge and $\text{CaCO}_3$ , moist, disturbed.
---------------	---

# SECOR

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## UU TRI-AXIAL COMPRESSIVE STRENGTH - COHESIVE SOILS (ASTM D 2850)

Client/Project:	Chevron/Purity
Job No.:	24CH.67001.00
Task:	0006
Sample ID:	SECOR Mix
Tested By:	TC
Date:	10/8/02

### RESULTS

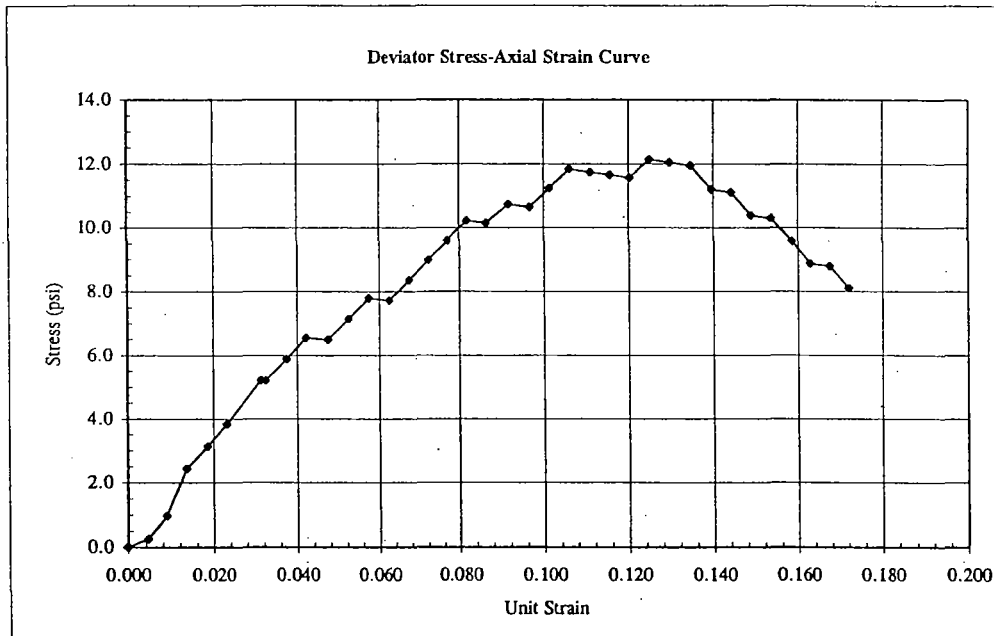
#### Initial Sample Data

Water Content	7.7%	
	lb/ft <sup>3</sup>	Mg/m <sup>3</sup>
Bulk Density	129.0	2.1
Dry Density	119.8	1.9

#### Final Sample Data

Water Content	8.1%
---------------	------

Confining Stress: 5.0 psi



	lb/in <sup>2</sup>	lb/ft <sup>2</sup>	kN/m <sup>2</sup>
Normal Failure Stress, $\sigma_1$	12.1	1,742	83
Shear Failure Stress, $\sigma_3$	6.1	871	42
Undrained Modulus of Elasticity*, $E_s$	303	43,560	2,086

\* Estimated using the secant method. Introduction to Geotechnical Engineering, Holtz, Robert D., and Kovacs, William D., p592, 1981.

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**LABORATORY DATA**

Confining Pressure: 5.0 psi  
Pore Water Pressure: 0.0 psi

### Test Data

### Initial Sample Properties

### Initial Water Content Data

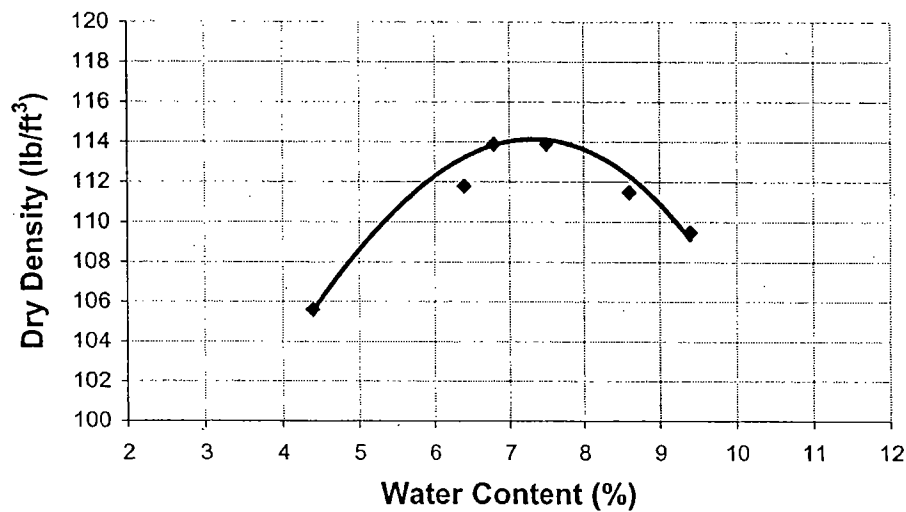
### Final Water Content Data

<b>Sample</b>	Grey silty sand with sludge and CaCO <sub>3</sub> . Moist, disturbed.
---------------	---

# Summary of Unconfined Compressive Strength Analyses

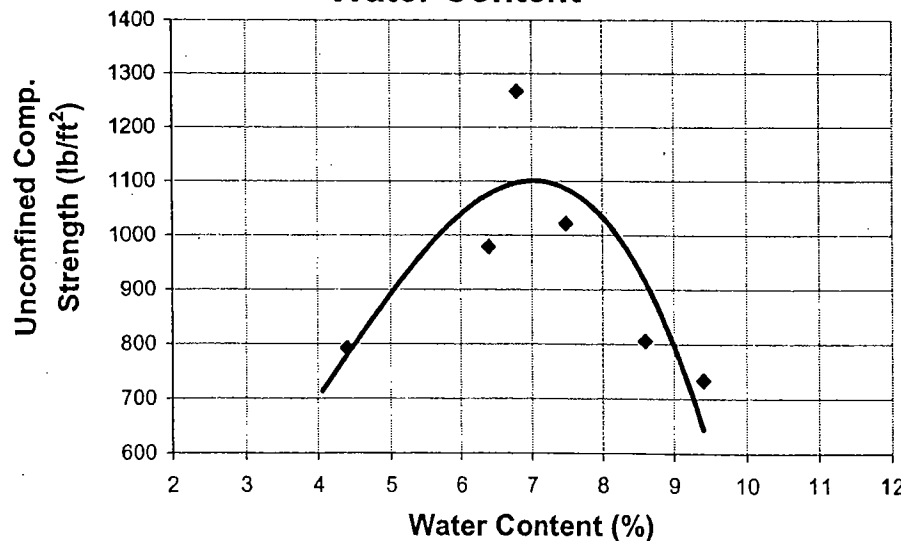
Test Number	1	2	3	4	5	6
Water Content (%)	4.4	6.4	6.8	7.5	8.6	9.4
Dry Density (lb/ft <sup>3</sup> )	105.6	111.8	113.9	113.9	111.5	109.5
Unconfined Compressive Strength (lb/ft <sup>2</sup> )	792	979	1267	1022	806	734

**Dry Density vs Water Content**



Maximum Dry Density (lb/ft <sup>3</sup> )	114.2
Optimum Water Content (%)	7.3

**Unconfined Compressive Strength vs Water Content**



Max. Unconfined Comp. Strength (lb/ft <sup>2</sup> )	1100
Optimum Water Content (%)	7.0

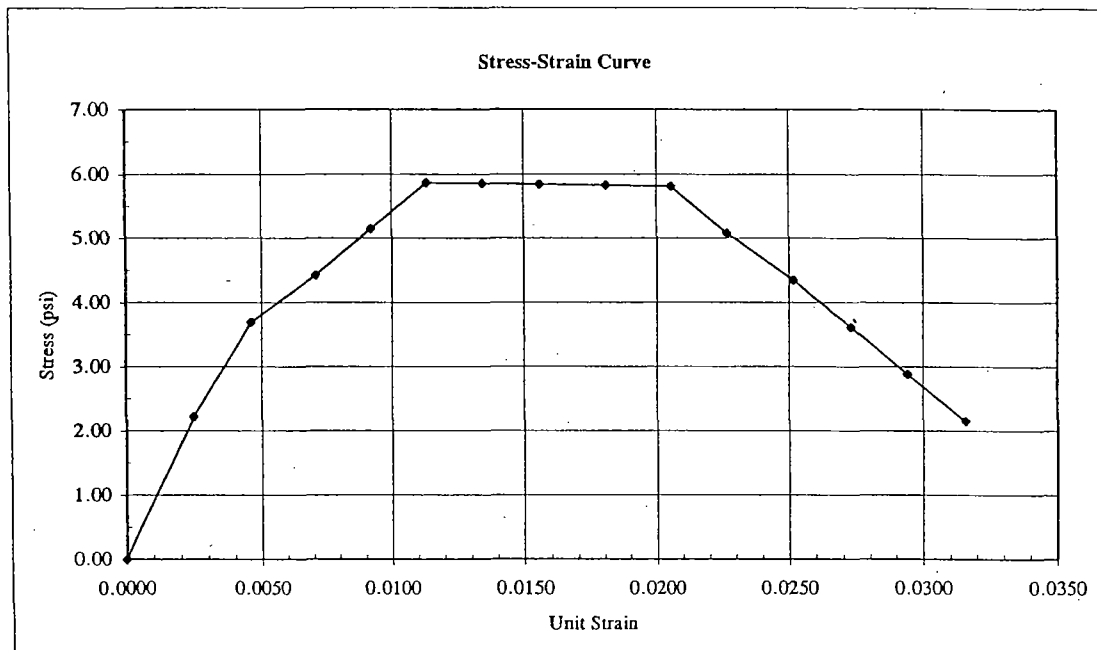
# SECOR

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## UNCONFINED COMPRESSIVE STRENGTH OF A COHESIVE SOIL (ASTM D 2166)

Client/Project:	Chevron/Purity
Job No.:	24CH67001.00
Task:	0006
Sample ID:	SECOR #1
Tested By:	TC
Date:	9/18/02

### RESULTS



	lb/in <sup>2</sup>	lb/ft <sup>2</sup>	kN/m <sup>2</sup>
Unconfined Compressive Strength, $q_u$	5.5	792	38
Shear Strength, $s_u$	2.8	396	19
Undrained Modulus of Elasticity*, $E_s$	79	11,314	542

### Density and Water Content

	lb/ft <sup>3</sup>	Mg/m <sup>3</sup>
Bulk Density	110.2	1.8
Dry Density	105.6	1.7

Water Content	4.4	%
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\* Estimated using the tangent method. Introduction to Geotechnical Engineering, Holtz, Robert D., and Kovacs, William D., p592, 1981.

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## UNCONFINED COMPRESSIVE STRENGTH OF A COHESIVE SOIL (ASTM D 2166)

Client/Project:	Chevron/Purity
Job No.:	24CH67001.00
Task:	0006
Sample ID:	SECOR #1
Tested By:	TC
Date:	9/18/02

## LABORATORY DATA

### Initial Sample Properties

Sample Diameter, $D_o$ (in)	1.31
Sample Height, $L_o$ (in)	2.82
Sample Mass (g)	109.92
Cross-Sectional Area, $A_o$ (in <sup>2</sup> )	1.35
$\Delta$ Height At 15% Strain (in)	0.42
Sample Condition	Disturbed

### Water Content Data

Mass of Tare (g)	0.83
Mass of Sample <sub>Natural</sub> + Tare (g)	109.85
Mass of Sample <sub>Dry</sub> + Tare (g)	105.28
Water Content (%)	4.4
Bulk Sample Density (lb/ft <sup>3</sup> )	110.19

**Sample Description:** Brown silty sand with gravel, sludge, and CaCO<sub>3</sub>.

Target water content approximately 5%.

### Test Data

[illegible]

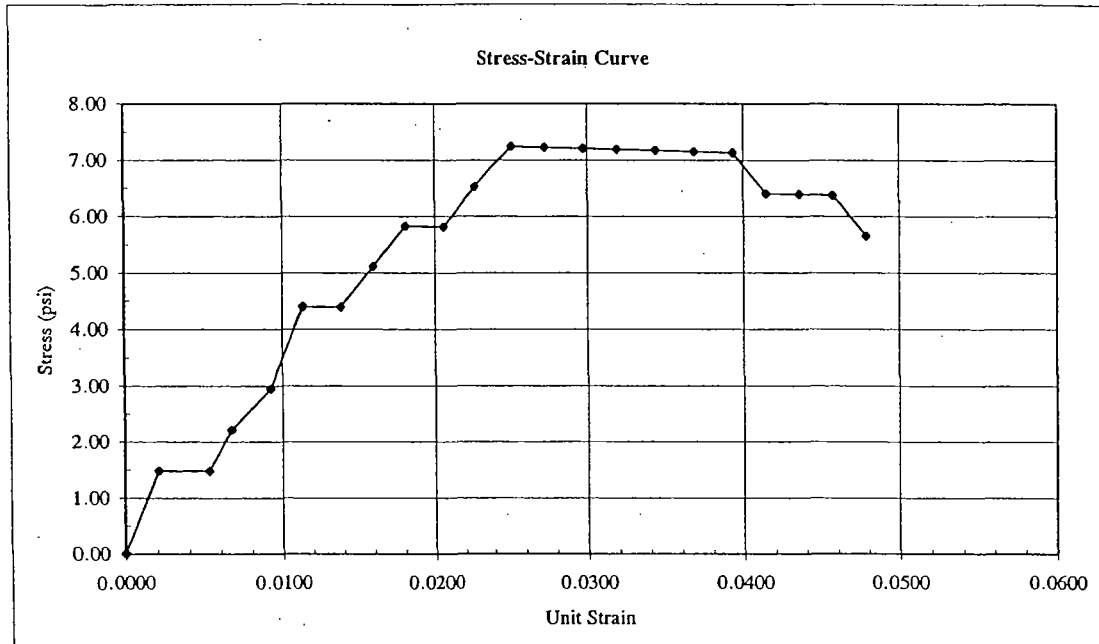
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## UNCONFINED COMPRESSIVE STRENGTH OF A COHESIVE SOIL (ASTM D 2166)

Client/Project:	Chevron/Purity
Job No.:	24CH67001.00
Task:	0006
Sample ID:	SECOR #2
Tested By:	TC
Date:	9/18/02

### RESULTS



	lb/in <sup>2</sup>	lb/ft <sup>2</sup>	kN/m <sup>2</sup>
Unconfined Compressive Strength, $q_u$	6.8	979	47
Shear Strength, $s_u$	3.4	490	23
Undrained Modulus of Elasticity*, $E_s$	97	13,989	670

### Density and Water Content

	lb/ft <sup>3</sup>	Mg/m <sup>3</sup>
Bulk Density	118.9	1.9
Dry Density	111.8	1.8

Water Content	6.4	%
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\* Estimated using the tangent method. Introduction to Geotechnical Engineering, Holtz, Robert D. and Kovacs, William D., p592, 1981.

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Client/Project:	Chevron/Purity
Job No.:	24CH67001.00
Task:	0006
Sample ID:	SECOR #2
Tested By:	TC
Date:	9/18/02

Sample Diameter, $D_o$ (in)	1.31
Sample Height, $L_o$ (in)	2.82
Sample Mass (g)	118.57
Cross-Sectional Area, $A_o$ ( $\text{in}^2$ )	1.35
$\Delta$ Height At 15% Strain (in)	0.42
Sample Condition	Disturbed

Mass of Tare (g)	0.74
Mass of Sample <sub>Natural</sub> + Tare (g)	119.14
Mass of Sample <sub>Dry</sub> + Tare (g)	112.06
Water Content (%)	6.4
Bulk Sample Density (lb/ft <sup>3</sup> )	118.86

Target water content approximately 7%.

[illegible]



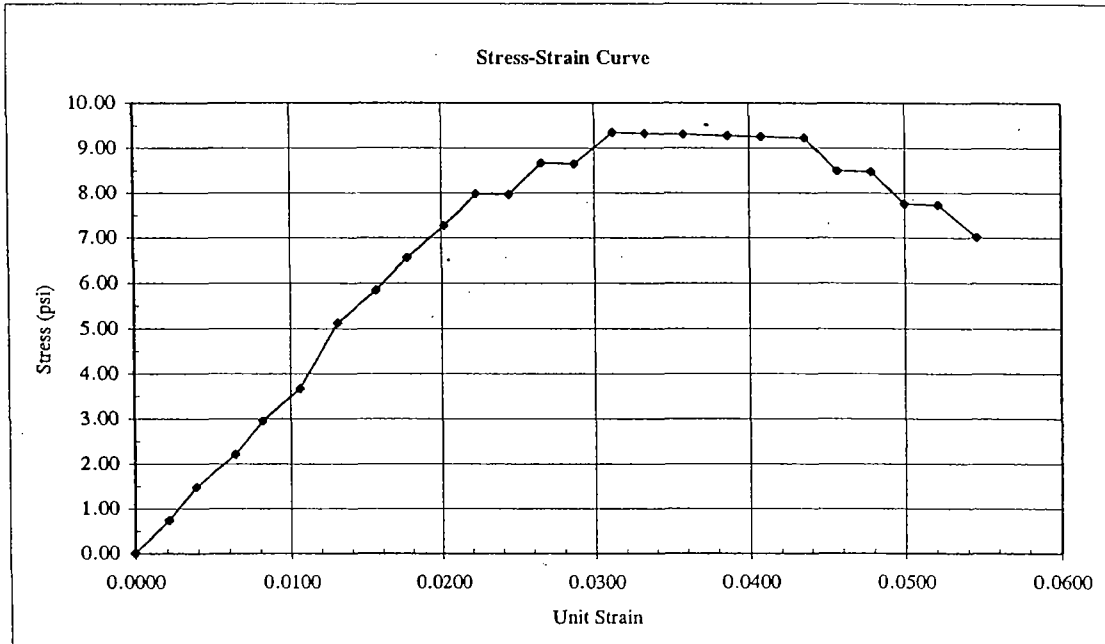
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## UNCONFINED COMPRESSIVE STRENGTH OF A COHESIVE SOIL (ASTM D 2166)

Client/Project:	Chevron/Purity
Job No.:	24CH67001.00
Task:	0006
Sample ID:	SECOR #3
Tested By:	TC
Date:	9/18/02

### RESULTS



	lb/in <sup>2</sup>	lb/ft <sup>2</sup>	kN/m <sup>2</sup>
Unconfined Compressive Strength, $q_u$	8.8	1,267	61
Shear Strength, $s_u$	4.4	634	30
Undrained Modulus of Elasticity*, $E_s$	126	18,103	867

### Density and Water Content

	lb/ft <sup>3</sup>	Mg/m <sup>3</sup>
Bulk Density	121.6	1.9
Dry Density	113.9	1.8

Water Content	6.8	%
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\* Estimated using the tangent method. Introduction to Geotechnical Engineering, Holtz, Robert D, and Kovacs, William D., p592, 1981.

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**UNCONFINED COMPRESSIVE STRENGTH OF A COHESIVE SOIL**  
(ASTM D 2166)

Client/Project:	Chevron/Purity
Job No.:	24CH67001.00
Task:	0006
Sample ID:	SECOR #3
Tested By:	TC
Date:	9/18/02

**LABORATORY DATA****Initial Sample Properties**

Sample Diameter, $D_o$ (in)	1.31
Sample Height, $L_o$ (in)	2.82
Sample Mass (g)	121.29
Cross-Sectional Area, $A_o$ (in <sup>2</sup> )	1.35
$\Delta$ Height At 15% Strain (in)	0.42
Sample Condition	Disturbed

**Water Content Data**

Mass of Tare (g)	0.93
Mass of Sample <sub>Natural</sub> + Tare (g)	122.07
Mass of Sample <sub>Dry</sub> + Tare (g)	114.37
Water Content (%)	6.8
Bulk Sample Density (lb/ft <sup>3</sup> )	121.59

Sample Description: Brown silty sand with gravel, sludge, and CaCO<sub>3</sub>.

Target water content approximately 7.5%.

**Test Data**

Sample Load (lb)	Dial Gauge Reading (in)	Sample Deformation $\Delta L$ , (in)	Unit Strain	Corrected Area (in <sup>2</sup> )	Unit Stress (psi)
0	0.667	0	0.0000	1.35	0.00
1.0	0.661	0.006	0.0021	1.35	0.74
2.0	0.656	0.011	0.0039	1.35	1.48
3.0	0.649	0.018	0.0064	1.36	2.21
4.0	0.644	0.023	0.0082	1.36	2.94
5.0	0.637	0.030	0.0106	1.36	3.67
7.0	0.630	0.037	0.0131	1.37	5.13
8.0	0.623	0.044	0.0156	1.37	5.84
9.0	0.617	0.050	0.0177	1.37	6.56
10.0	0.610	0.057	0.0202	1.38	7.27
11.0	0.604	0.063	0.0223	1.38	7.98
11.0	0.598	0.069	0.0245	1.38	7.96
12.0	0.592	0.075	0.0266	1.38	8.67
12.0	0.586	0.081	0.0287	1.39	8.65
13.0	0.579	0.088	0.0312	1.39	9.34
13.0	0.573	0.094	0.0333	1.39	9.32
13.0	0.566	0.101	0.0358	1.40	9.30
13.0	0.558	0.109	0.0387	1.40	9.27
13.0	0.552	0.115	0.0408	1.41	9.25
13.0	0.544	0.123	0.0436	1.41	9.22
12.0	0.538	0.129	0.0457	1.41	8.50
12.0	0.532	0.135	0.0479	1.42	8.48
11.0	0.526	0.141	0.0500	1.42	7.75
11.0	0.520	0.147	0.0521	1.42	7.74
10.0	0.513	0.154	0.0546	1.43	7.01

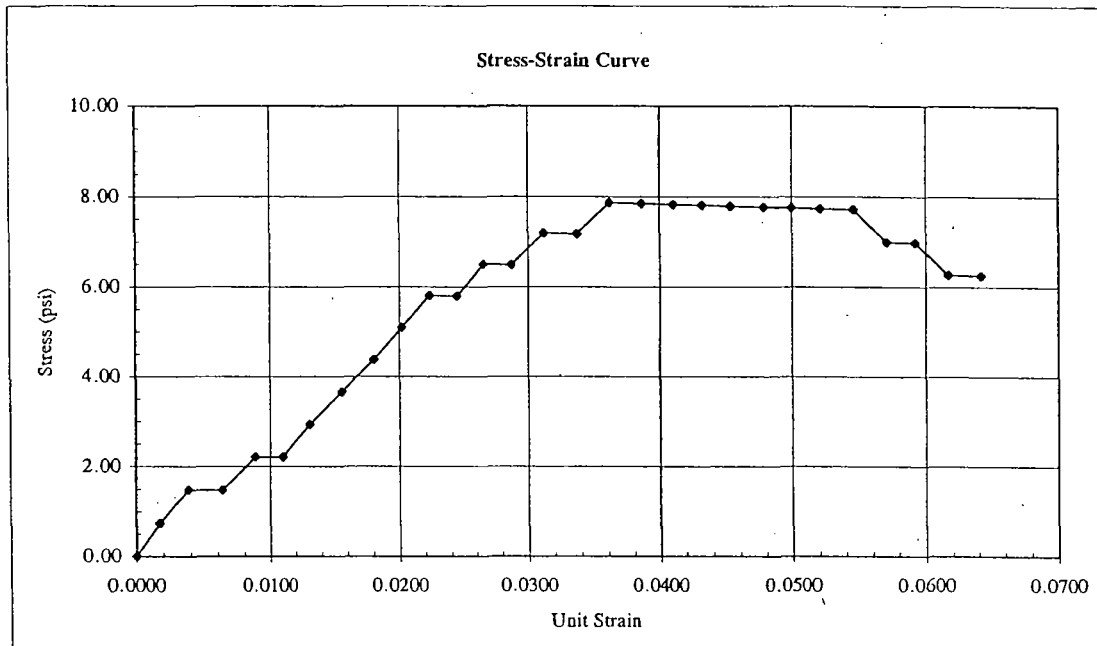
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## UNCONFINED COMPRESSIVE STRENGTH OF A COHESIVE SOIL (ASTM D 2166)

Client/Project:	Chevron/Purity
Job No.:	24CH67001.00
Task:	0006
Sample ID:	SECOR #4
Tested By:	TC
Date:	9/19/02

### RESULTS



	lb/in <sup>2</sup>	lb/ft <sup>2</sup>	kN/m <sup>2</sup>
Unconfined Compressive Strength, $q_u$	7.1	1,022	49
Shear Strength, $s_u$	3.6	511	24
Undrained Modulus of Elasticity*, Es	101	14,606	699

### Density and Water Content

	lb/ft <sup>3</sup>	Mg/m <sup>3</sup>
Bulk Density	122.5	2.0
Dry Density	113.9	1.8

Water Content	7.5	%
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\* Estimated using the tangent method. Introduction to Geotechnical Engineering, Holtz, Robert D., and Kovacs, William D., p592, 1981.

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## UNCONFINED COMPRESSIVE STRENGTH OF A COHESIVE SOIL (ASTM D 2166)

Client/Project:	Chevron/Purity
Job No.:	24CH67001.00
Task:	0006
Sample ID:	SECOR #4
Tested By:	TC
Date:	9/19/02

### LABORATORY DATA

#### Initial Sample Properties

Sample Diameter, $D_o$ (in)	1.31
Sample Height, $L_o$ (in)	2.82
Sample Mass (g)	122.20
Cross-Sectional Area, $A_o$ (in <sup>2</sup> )	1.35
$\Delta$ Height At 15% Strain (in)	0.42
Sample Condition	Disturbed

#### Water Content Data

Mass of Tare (g)	1.05
Mass of Sample <sub>Natural</sub> + Tare (g)	123.07
Mass of Sample <sub>Dry</sub> + Tare (g)	114.51
Water Content (%)	7.5
Bulk Sample Density (lb/ft <sup>3</sup> )	122.50

Sample Description: Brown silty sand with gravel, sludge, and CaCO<sub>3</sub>.

Target water content approximately 8%.

#### Test Data

Sample Load (lb)	Dial Gauge Reading (in)	Sample Deformation $\Delta L$ , (in)	Unit Strain	Corrected Area (in <sup>2</sup> )	Unit Stress (psi)
0	0.661	0	0.0000	1.35	0.00
1.0	0.656	0.005	0.0018	1.35	0.74
2.0	0.650	0.011	0.0039	1.35	1.48
2.0	0.643	0.018	0.0064	1.36	1.47
3.0	0.636	0.025	0.0089	1.36	2.21
3.0	0.630	0.031	0.0110	1.36	2.20
4.0	0.624	0.037	0.0131	1.37	2.93
5.0	0.617	0.044	0.0156	1.37	3.65
6.0	0.610	0.051	0.0181	1.37	4.37
7.0	0.604	0.057	0.0202	1.38	5.09
8.0	0.598	0.063	0.0223	1.38	5.80
8.0	0.592	0.069	0.0245	1.38	5.79
9.0	0.586	0.075	0.0266	1.38	6.50
9.0	0.580	0.081	0.0287	1.39	6.49
10.0	0.573	0.088	0.0312	1.39	7.19
10.0	0.566	0.095	0.0337	1.39	7.17
11.0	0.559	0.102	0.0362	1.40	7.87
11.0	0.552	0.109	0.0387	1.40	7.85
11.0	0.545	0.116	0.0411	1.41	7.83
11.0	0.539	0.122	0.0433	1.41	7.81
11.0	0.533	0.128	0.0454	1.41	7.79
11.0	0.526	0.135	0.0479	1.42	7.77
11.0	0.520	0.141	0.0500	1.42	7.75
11.0	0.514	0.147	0.0521	1.42	7.74
11.0	0.507	0.154	0.0546	1.43	7.72
10.0	0.500	0.161	0.0571	1.43	7.00
10.0	0.494	0.167	0.0592	1.43	6.98
9.0	0.487	0.174	0.0617	1.44	6.27
9.0	0.480	0.181	0.0642	1.44	6.25

# SECOR

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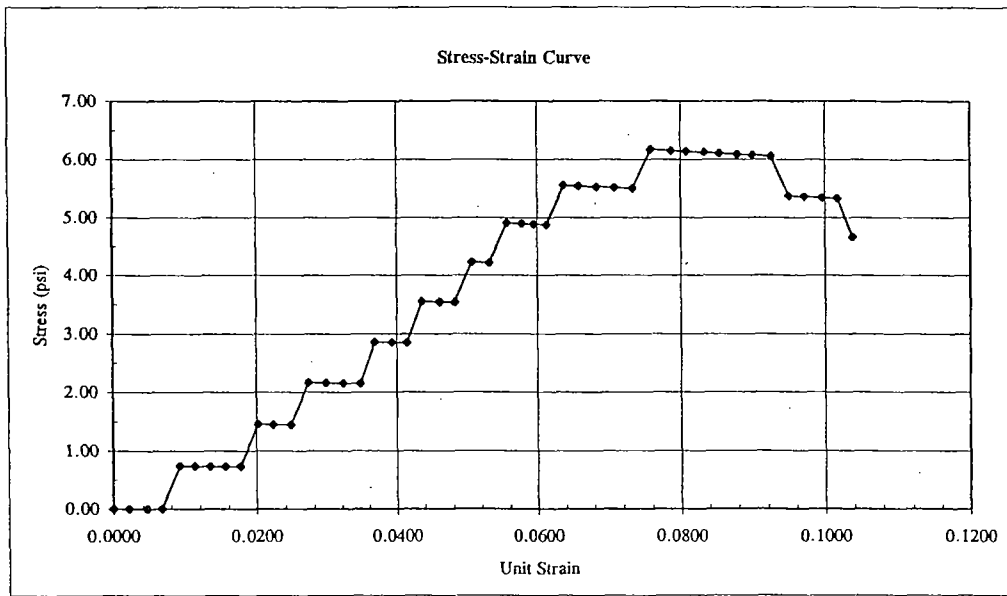
Suite E

Okemos, MI 48864

## UNCONFINED COMPRESSIVE STRENGTH OF A COHESIVE SOIL (ASTM D 2166)

Client/Project:	Chevron/Purity
Job No.:	24CH67001.00
Task:	0006
Sample ID:	SECOR #5
Tested By:	TC
Date:	9/19/02

### RESULTS



	lb/in <sup>2</sup>	lb/ft <sup>2</sup>	kN/m <sup>2</sup>
Unconfined Compressive Strength, $q_u$	5.6	806	39
Shear Strength, $s_u$	2.8	403	19
Undrained Modulus of Elasticity*, $E_s$	80	11,520	552

### Density and Water Content

	lb/ft <sup>3</sup>	Mg/m <sup>3</sup>
Bulk Density	121.0	1.9
Dry Density	111.5	1.8

Water Content	8.6	%
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\* Estimated using the tangent method. Introduction to Geotechnical Engineering, Holtz, Robert D, and Kovacs, William D., p592, 1981.

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## UNCONFINED COMPRESSIVE STRENGTH OF A COHESIVE SOIL (ASTM D 2166)

Client/Project:	Chevron/Purity
Job No.:	24CH67001.00
Task:	0006
Sample ID:	SECOR #5
Tested By:	TC
Date:	9/19/02

### LABORATORY DATA

#### Initial Sample Properties

Sample Diameter, $D_s$ (in)	1.31
Sample Height, $L_s$ (in)	2.82
Sample Mass (g)	120.75
Cross-Sectional Area, $A_s$ (in <sup>2</sup> )	1.35
$\Delta$ Height At 15% Strain (in)	0.42
Sample Condition	Disturbed

#### Water Content Data

Mass of Tare (g)	0.99
Mass of Sample <sub>Natural</sub> + Tare (g)	121.09
Mass of Sample <sub>Dry</sub> + Tare (g)	111.57
Water Content (%)	8.6
Bulk Sample Density (lb/ft <sup>3</sup> )	121.05

Sample Description: Brown silty sand with gravel, sludge, and CaCO<sub>3</sub>.

Target water content approximately 9%.

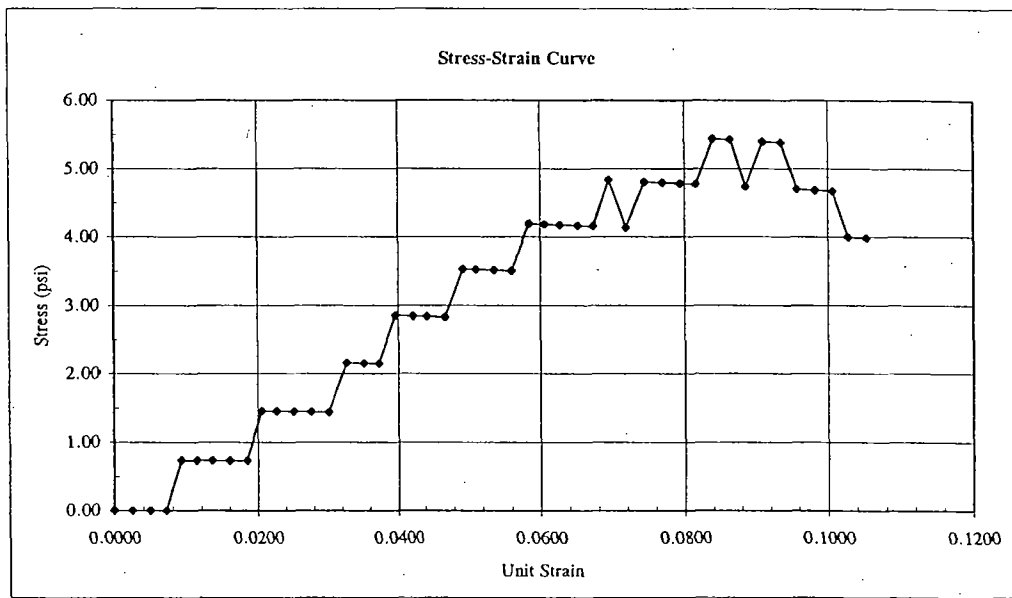
#### Test Data

Sample Load (lb)	Dial Gauge Reading (in)	Sample Deformation $\Delta L_s$ (in)	Unit Strain	Corrected Area (in <sup>2</sup> )	Unit Stress (psi)
0	0.641	0	0.0000	1.35	0.00
0.0	0.635	0.006	0.0021	1.35	0.00
0.0	0.628	0.013	0.0046	1.35	0.00
0.0	0.622	0.019	0.0067	1.36	0.00
1.0	0.615	0.026	0.0092	1.36	0.74
1.0	0.609	0.032	0.0113	1.36	0.73
1.0	0.603	0.038	0.0135	1.37	0.73
1.0	0.597	0.044	0.0156	1.37	0.73
1.0	0.591	0.050	0.0177	1.37	0.73
2.0	0.584	0.057	0.0202	1.38	1.45
2.0	0.578	0.063	0.0223	1.38	1.45
2.0	0.571	0.070	0.0248	1.38	1.45
3.0	0.564	0.077	0.0273	1.39	2.17
3.0	0.557	0.084	0.0298	1.39	2.16
3.0	0.550	0.091	0.0323	1.39	2.15
3.0	0.543	0.098	0.0348	1.40	2.15
4.0	0.537	0.104	0.0369	1.40	2.86
4.0	0.530	0.111	0.0394	1.40	2.85
4.0	0.524	0.117	0.0415	1.41	2.84
5.0	0.518	0.123	0.0436	1.41	3.55
5.0	0.511	0.130	0.0461	1.41	3.54
5.0	0.505	0.136	0.0482	1.42	3.53
6.0	0.498	0.143	0.0507	1.42	4.23
6.0	0.491	0.150	0.0532	1.42	4.21
7.0	0.484	0.157	0.0557	1.43	4.90
7.0	0.478	0.163	0.0578	1.43	4.89
7.0	0.473	0.168	0.0596	1.43	4.88
7.0	0.468	0.173	0.0613	1.44	4.87
8.0	0.461	0.180	0.0638	1.44	5.56
8.0	0.455	0.186	0.065957	1.44	5.54
8.0	0.448	0.193	0.068440	1.45	5.53
8.0	0.441	0.2	0.070922	1.45	5.51
8.0	0.434	0.207	0.073404	1.45	5.50
9.0	0.427	0.214	0.075887	1.46	6.17
9.0	0.419	0.222	0.078723	1.46	6.15
9.0	0.413	0.228	0.080851	1.47	6.14
9.0	0.406	0.235	0.083333	1.47	6.12
9.0	0.4	0.241	0.085461	1.47	6.11
9.0	0.393	0.248	0.087943	1.48	6.09
9.0	0.387	0.254	0.090071	1.48	6.08
9.0	0.38	0.261	0.092553	1.49	6.06
8.0	0.373	0.268	0.095035	1.49	5.37
8.0	0.367	0.274	0.097163	1.49	5.36
8.0	0.36	0.281	0.099645	1.50	5.34
8.0	0.354	0.287	0.101773	1.50	5.33
7.0	0.348	0.293	0.103901	1.50	4.65

**UNCONFINED COMPRESSIVE STRENGTH OF A COHESIVE SOIL**  
(ASTM D 2166)

Client/Project:	Chevron/Purity
Job No.:	24CH67001.00
Task:	0006
Sample ID:	SECOR #6
Tested By:	TC
Date:	9/19/02

**RESULTS**



	lb/in <sup>2</sup>	lb/ft <sup>2</sup>	kN/m <sup>2</sup>
Unconfined Compressive Strength, $q_u$	5.1	734	35
Shear Strength, $s_u$	2.6	367	18
Undrained Modulus of Elasticity <sup>*</sup> , $E_s$	73	10,491	502

**Density and Water Content**

	lb/ft <sup>3</sup>	Mg/m <sup>3</sup>
Bulk Density	119.8	1.9
Dry Density	109.5	1.8

Water Content	9.4	%
---------------	-----	---

<sup>\*</sup> Estimated using the tangent method. Introduction to Geotechnical Engineering, Holtz, Robert D, and Kovacs, William D., p592, 1981.

# SECOR

International Incorporated  
Geotechnical Laboratory  
2321 Club Meridian Drive  
Suite E  
Okemos, MI 48864

## UNCONFINED COMPRESSIVE STRENGTH OF A COHESIVE SOIL (ASTM D 2166)

Client/Project:	Chevron/Purity
Job No.:	24CH67001.00
Task:	0006
Sample ID:	SECOR #6
Tested By:	TC
Date:	9/19/02

### LABORATORY DATA

#### Initial Sample Properties

Sample Diameter, $D_s$ (in)	1.31
Sample Height, $L_s$ (in)	2.82
Sample Mass (g)	119.53
Cross-Sectional Area, $A_s$ (in <sup>2</sup> )	1.35
$\Delta$ Height At 15% Strain (in)	0.42
Sample Condition	Disturbed

#### Water Content Data

Mass of Tare (g)	1.02
Mass of Sample <sub>Natural</sub> + Tare (g)	120.40
Mass of Sample <sub>Dry</sub> + Tare (g)	110.12
Water Content (%)	9.4
Bulk Sample Density (lb/ft <sup>3</sup> )	119.83

Sample Description: Brown silty sand with gravel, sludge, and CaCO<sub>3</sub>.

Target water content approximately 10%.

#### Test Data

Sample Load (lb)	Dial Gauge Reading (in)	Sample Deformation $\Delta L_s$ (in)	Unit Strain	Corrected Area (in <sup>2</sup> )	Unit Stress (psi)
0	0.655	0	0.0000	1.35	0.00
0.0	0.648	0.007	0.0025	1.35	0.00
0.0	0.641	0.014	0.0050	1.35	0.00
0.0	0.635	0.020	0.0071	1.36	0.00
1.0	0.629	0.026	0.0092	1.36	0.74
1.0	0.623	0.032	0.0113	1.36	0.73
1.0	0.617	0.038	0.0135	1.37	0.73
1.0	0.610	0.045	0.0160	1.37	0.73
1.0	0.603	0.052	0.0184	1.37	0.73
2.0	0.597	0.058	0.0206	1.38	1.45
2.0	0.591	0.064	0.0227	1.38	1.45
2.0	0.584	0.071	0.0252	1.38	1.45
2.0	0.577	0.078	0.0277	1.39	1.44
2.0	0.570	0.085	0.0301	1.39	1.44
3.0	0.563	0.092	0.0326	1.39	2.15
3.0	0.556	0.099	0.0351	1.40	2.15
3.0	0.550	0.105	0.0372	1.40	2.14
4.0	0.543	0.112	0.0397	1.40	2.85
4.0	0.536	0.119	0.0422	1.41	2.84
4.0	0.530	0.125	0.0443	1.41	2.84
4.0	0.523	0.132	0.0468	1.41	2.83
5.0	0.516	0.139	0.0493	1.42	3.53
5.0	0.511	0.144	0.0511	1.42	3.52
5.0	0.504	0.151	0.0535	1.42	3.51
5.0	0.497	0.158	0.0560	1.43	3.50
6.0	0.490	0.165	0.0585	1.43	4.19
6.0	0.484	0.171	0.0606	1.43	4.18
6.0	0.478	0.177	0.0628	1.44	4.17
6.0	0.471	0.184	0.0652	1.44	4.16
6.0	0.465	0.19	0.067376	1.45	4.15
7.0	0.459	0.196	0.069504	1.45	4.83
6.0	0.452	0.203	0.071986	1.45	4.13
7.0	0.445	0.21	0.074468	1.46	4.81
7.0	0.438	0.217	0.076950	1.46	4.79
7.0	0.431	0.224	0.079433	1.46	4.78
7.0	0.425	0.23	0.081560	1.47	4.77
8.0	0.418	0.237	0.084043	1.47	5.44
8.0	0.411	0.244	0.086525	1.48	5.42
7.0	0.405	0.25	0.088652	1.48	4.73
8.0	0.398	0.257	0.091135	1.48	5.39
8.0	0.391	0.264	0.093617	1.49	5.38
7.0	0.385	0.27	0.095745	1.49	4.70
7.0	0.378	0.277	0.098227	1.49	4.68
7.0	0.371	0.284	0.100709	1.50	4.67
6.0	0.365	0.29	0.102837	1.50	3.99
6.0	0.358	0.297	0.105319	1.51	3.98



# SECOR

International Incorporated  
Geotechnical Laboratory  
2321 Club Meridian Drive  
Suite E  
Okemos, MI 48864

Client/Project:	CVX Purity Oil
Job No.:	24CH.67001.01
Task:	0007
Sample ID:	1:1 Mix Batch
Tested By:	TC/ZK
Date:	6/19/03

## MOISTURE/DENSITY RELATIONS FOR GRANULAR SOILS (ASTM D 698)

Standard Compactive Effort Using 5.5 lb Hammer and 4" Mold

### Soil Description:

Brown silty sand with some gravel, rubble and neutralized sludge material. Recipe created from 1' of neutralized sludge and 1' of overburden soil. Sample taken from batch PTA1-30.

### Standard Proctor Compaction Test

#### Initial Soil Data

Mass of Tare	0.4	grams
Mass of Soil + Tare	29.9	grams
Mass of Soil	27.38	grams
Mass of Water	2.52	grams
Initial Water Content	9.3	%

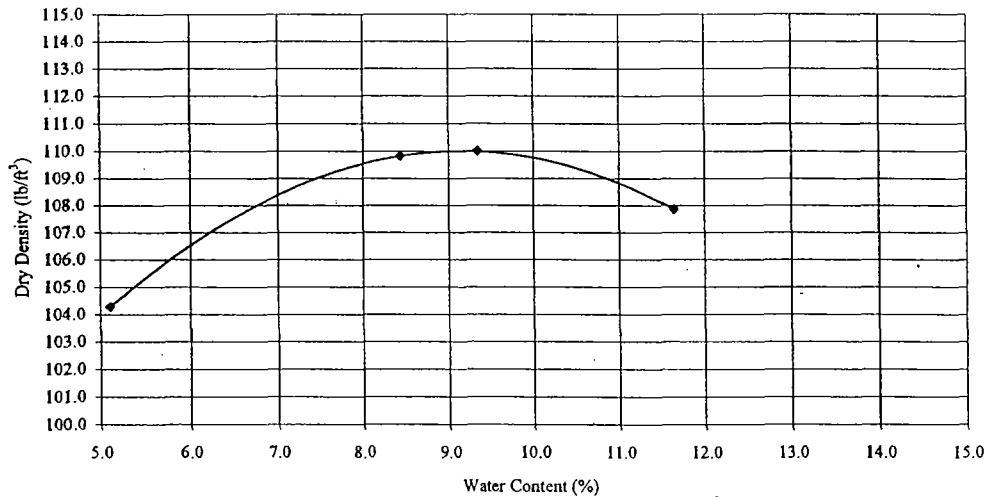
#### Compaction Mold Data

Mass of Mold	10.135	lb
Volume of Mold	0.0333	ft <sup>3</sup>

#### Compaction Data

Target Water Content (%)	Water Added (mL)	Mold & Material (lb)	Wet Material (lb)	Wet Density (lb/ft <sup>3</sup> )	Tare Mass (grams)	Tare + Soil (grams)	Tare + Soil (grams)	Actual Water Content (%)	Dry Density (lb/ft <sup>3</sup> )	Dry Density (Mg/m <sup>3</sup> )
9	0.0	14.140	4.0050	120.3	0.40	29.90	27.38	9.3	110.0	1.76
7.5	0.0	13.785	3.6500	109.6	0.40	25.70	24.47	5.1	104.3	1.67
8	100.0	14.100	3.9650	119.1	0.40	25.35	23.41	8.4	109.8	1.76
11.5	100.0	14.145	4.0100	120.4	0.40	30.21	27.10	11.6	107.9	1.73

Dry Density vs. Water Content



Maximum Dry Density	
(Mg/m <sup>3</sup> )	(lb/ft <sup>3</sup> )
1.76	110.0

Optimum Water Content (%)
9.1

### Comments:

**SECOR**  
International Incorporated  
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Suite E  
Okemos, MI 48864

**MOISTURE/DENSITY RELATIONS FOR GRANULAR SOILS (ASTM D 698)**

Standard Compactive Effort Using 5.5 lb Hammer and 4" Mold

Client/Project:	CVX Purity Oil
Job No.:	24CH.67001.01
Task:	0007
Sample ID:	1.5:1 Mix Batch
Tested By:	TC/ZK
Date:	6/18/03

**Soil Description:**

Brown silty sand with some gravel, rubble and neutralized sludge material. Recipe created from 1' of neutralized sludge and 1.5' of overburden soil. Sample taken from batch PTA1-28.

**Standard Proctor Compaction Test**

**Initial Soil Data**

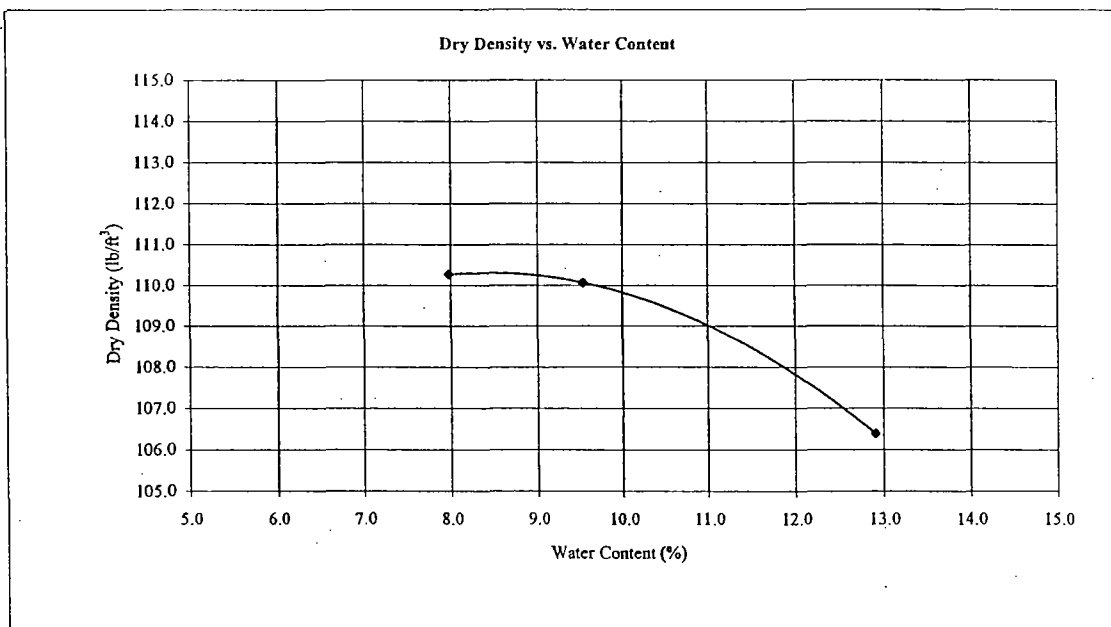
Mass of Tare	0.4	grams
Mass of Soil	33.82	grams
Mass of Soil	31.35	grams
Mass of Water	2.47	grams
Initial Water Content	8.0	%

**Compaction Mold Data**

Mass of Mold	10.135	lb
Volume of Mold	0.0333	ft <sup>3</sup>

**Compaction Data**

Water (%)	Water Added (mL)	Mold & Material (lb)	Wet Material (lb)	Wet Density (lb/ft <sup>3</sup> )	Tare Mass (grams)	Tare Soil (grams)	Tare Soil (grams)	Actual (lb)	Dry Density (lb/ft <sup>3</sup> )	Dry Density (Mg/m <sup>3</sup> )
8	0.0	14.100	3.965	119.1	0.40	33.82	31.35	8.0	110.3	1.77
10	70.0	14.150	4.015	120.6	0.40	29.55	27.01	9.5	110.1	1.76
12	70.0	14.135	4.000	120.1	0.40	26.29	23.33	12.9	106.4	1.70



**Comments:**

# SECOR

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2321 Club Meridian Drive

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## MOISTURE/DENSITY RELATIONS FOR GRANULAR SOILS (ASTM D 698)

Standard Compactive Effort Using 5.5 lb Hammer and 4" Mold

Client/Project:	CVX Purity Oil
Job No.:	24CH.67001.01
Task:	0007
Sample ID:	2:1 Remix Batch
Tested By:	TC/ZK
Date:	6/18/03

### Soil Description:

Brown silty sand with some gravel, rubble and neutralized sludge material. Recipe created from 1' of neutralized sludge and 2' of previously mixed sludge/CaCO<sub>3</sub>/soil material. Sample taken from batch PTA1-29.

### Standard Proctor Compaction Test

#### Initial Soil Data

Mass of Tare	0.4	grams
Mass of Soil	32.6	grams
Mass of Soil	29.8	grams
Mass of Water	2.8	grams
Initial Water Content	9.5	%

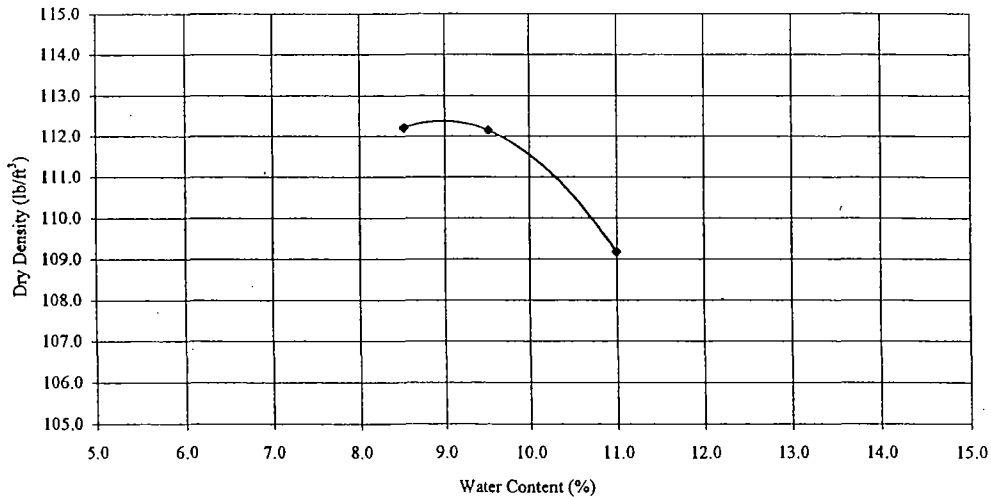
#### Compaction Mold Data

Mass of Mold	10.135	lb
Volume of Mold	0.0333	ft <sup>3</sup>

#### Compaction Data

Target (%)	Water Added (ml)	Mold & Material (lb)	Wet Material (lb)	Wet Density (lb/ft <sup>3</sup> )	Tare Mass (grams)	Tare Soil (grams)	Tare Soil (grams)	Actual (%)	Dry Density (lb/ft <sup>3</sup> )	Dry Density (kg/m <sup>3</sup> )
9	0.0	14.225	4.090	122.8	0.40	32.60	29.80	9.5	112.1	1.80
8	0.0	14.190	4.055	121.8	0.40	19.50	18.00	8.5	112.2	1.80
11	100.0	14.170	4.035	121.2	0.40	28.06	25.32	11.0	109.2	1.75

Dry Density vs. Water Content



Maximum Dry Density	
(kg/m <sup>3</sup> )	(lb/ft <sup>3</sup> )
1.80	112.4

Optimum Water Content (%)
9.0

### Comments:

**APPENDIX A**  
**GEOTECHNICAL ANALYSES**

# MEMORANDUM

**TO:** Scott Jordan, Project Coordinator (SECOR)  
**FROM:** Todd D. Shibata, Senior Engineer (SECOR)  
**SUBJECT:** CHEVRON - PURITY OIL SITE  
Revised Slope Stability Analysis  
**DATE:** May 20, 2002

---

SECOR has reviewed the slope stability analysis previously prepared by Smith Environmental (Smith) in 1996, which was subsequently re-evaluated by the IT Corporation (IT) in 2001. Following our review of the referenced slope stability analyses, SECOR has revised the slope stability model to reflect the most current design conditions. This revised slope stability analysis is described as follows.

## SLOPE GEOMETRY

The geometry of the existing slopes was evaluated based on the proposed final cover design, the recent topographic survey of the site, and a previous cross section of the site that was prepared by Smith (1996). The slopes will be graded at inclination approximately 3:1 (horizontal to vertical). The maximum height of the waste materials is approximately 12 feet. The waste materials will be overlain by a final cover system. On the top of the landfill, the final cover will consist of a two-foot thick foundation layer overlying the waste materials, followed by the geosynthetic clay liner (GCL), geomembrane, drainage geonet and a two-foot thick vegetative layer. On the sideslopes of the landfill, the final cover will consist of a two-foot thick foundation layer overlying the waste materials. The foundation layer will be separated from the waste materials with a geosynthetic, non-woven filter fabric. Overlying the foundation layer will be a GCL, followed by a two-foot thick vegetative layer. As indicated on Smith's cross-section, waste materials were placed below the existing grade in sumps as deep as 12 feet. The slope configurations of the sump excavations were at an inclination approximately 8:1 (horizontal to vertical). For analysis, a sump excavation was assumed located under the toe of the slope.

## SOIL PROPERTIES

The soil properties previously modeled by Smith and IT were reviewed to determine their sufficiency based on the observed current and past conditions, and the proposed design conditions. The Smith and IT soil properties were modified where necessary.

To accurately reflect the proposed final cover design, SECOR's slope stability analysis considered the actual soil properties of the final cover design opposed to modeling the cover as boundary load. Conservative soil properties were chosen for the material types to be placed in the final cover.

The soil properties of the waste material were modified to correctly account for shear strength properties based upon SECOR's observation of the waste materials at the site and Smith's previous laboratory testing. The average cohesion determined from several unconfined compressive strength tests was utilized in SECOR's analysis, similar to the Smith and IT analysis. However, assigning a friction angle of zero to the waste material is too conservative a design

assumption. The average friction angle of the waste soil samples tested by Smith for unconsolidated, undrained triaxial shear strength was equal to 33.9. Smith concluded that a friction angle should not be used for the waste materials to account for the build up of soil water pore pressure in the low-permeability waste materials following final cover placement. It is unlikely that soil water pore pressure will increase following final cover placement. Although the waste materials will not benefit from the effects of evapotranspiration, one purpose of the final cover is to decrease the amount of water infiltration. Therefore, assigning a friction angle to the waste materials appears appropriate. For extremely conservative design purposes, only 15 percent of the average tested friction angle was utilized in the analysis. A summary of the soil properties utilized in SECOR's analysis is summarized in the following table.

Material Type	Wet Density (pcf)	Cohesion, C (psf)	Friction Angle, $\phi$ (degrees)
Vegetation Layer	120	0	28
GCL / Soil Interface	85	0	24
Foundation Layer	125	0	30
Waste Material	107	275	5
Native Sand	106	0	40

## SEISMIC CONDITIONS

The site, as is all of California, is located in a seismically active area. Ground motions were estimated corresponding to a design bound earthquake (DBE), having a 10 percent probability of exceedance over a 50-year time period. The site-specific peak ground acceleration (PGA) for the DBE was estimated through a probabilistic seismic hazard analysis (PSHA) using the computer program FRISKSP, Version 4.00. The faults used in the PSHA were based upon the current CDMG fault catalog.

The PGA was developed using Boore's 1997 ground motion attenuation relation for soils with a shear wave velocity equal to 310 m/s. Dispersion in Boore's ground motion attenuation relationship was considered by inclusion of the standard deviation of the ground motion data in the attenuation relationship used in the PSHA. The estimated PGA for the DBE is 0.13g.

Slope stability analysis that includes earthquake loading generally is modeled by pseudo-static conditions. Pseudo-static conditions consider earthquake loading, as represented by an equivalent horizontal force. This horizontal force is a percentage of the weight of the failure sliding mass. This percentage is referred to as the seismic coefficient (k).

An appropriate seismic coefficient is typically between 10 and 15 percent for earthquake magnitudes between 6.5 and 8.25 (Seed, 1979). The seismic coefficient is generally selected as some fraction of the PGA to represent the repeatable accelerations that the sliding mass might be subject to, opposed the short term peak acceleration. Research has shown that a seismic coefficient equal to 50 percent of the PGA will generally result in permanent seismic deformations less than two inches (Hynes and Franklin, 1984, and Anderson and Kavazanjian, 1995). Deformations less than four inches are unlikely to correspond to serious landslide movement and damage (CDMG, 1997).

A seismic coefficient equal to seven percent was utilized for the psuedo-static slope stability analysis. In addition, the maximum seismic coefficient capable of maintaining a safety factor greater than 1.1 was determined.

## METHOD OF ANALYSIS

Stability analysis was made by evaluating both translational (block) and rotational failure conditions. In translational failure, the potential slip surface is composed of planar segments. In rotational failure, numerous circular shaped potential slip surfaces were analyzed by the Bishop Method. The factor of safety against global slope stability failure was evaluated for the "worst case" slip surface (lowest safety factor) through the use of the computer program "GSLOPE," developed by MITRE Software Corporation.

A summary of SECOR's slope stability analysis is summarized in the following table. Additionally, the graphic results of the slope stability analyses are included in Appendix A. The minimum acceptable factor of safety is generally 1.1 under psuedo-static loading conditions and 1.5 for static loading conditions.

Failure Surface	Static FS	Pseudo-Static FS ( $k=0.07$ )	$k_{min}$ (Pseudo-Static FS=1.1)
Circular	1.7	1.4	0.14
Block	1.8	1.5	0.19

The calculated factors of safety exceed the minimum acceptable factors of safety. Additionally, the maximum seismic coefficient that will have an acceptable factor of safety under seismic loading is greater than the site specific PGA. Consequently the risk of failure is expected to be minimal.

## SUBGRADE COMPACTION CONSIDERATIONS

As indicated in SECOR's memorandum dated May 20, 2002, it appears that subgrade compaction requirements are too restrictive, as specified in Smith's Earthwork Specifications. In addition, mitigative measures (i.e. lime treatment) are not necessary to stabilize the landfill slopes. The conservative soil parameters utilized to model the waste materials, including the subgrade of the sideslopes, assume a low density and relatively weak soil type. Nominal compactive effort would be required to achieve these modeled parameters in the waste materials.

Please contact me at your convenience if you have any questions or comments.

## References:

Anderson, D.G. and Kavazanjian, E., April 7, 1995, Performance of Landfills under Seismic Loading," Invited State-of-the-Art Paper for the Third International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, University of Missouri, Rolla.

California Division of Mines and Geology (CDMG), 1997, Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California.

Hynes, M.E. and Franklin, A.G., 1984, "Rationalizing the Seismic Coefficient Method," Miscellaneous Paper GL-84-13, US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

IT Corporation, September 6, 2001, Results of Slope Stability Analysis, Purity Oil Sales Site, Malaga, CA, Memorandum to Ken Obenauf, From Sunil Kishani.

Seed, H.B., 1979, Considerations in the Earthquake-Resistant Design of Earth and Rockfill Dams, Geotechnique, Volume 29, Number 3.

Smith Environmental (Smith), May 31, 1996, Final (100%) Design Report, Operable Unit Two (OU-2), Purity Oil Sales Site, Fresno, California.

Enclosures: Appendix A – Slope Stability Analyses



# MEMORANDUM

**TO:** Tom Cole  
**FROM:** Todd Shibata  
**SUBJECT:** CHEVRON – PURITY OIL SITE  
Slope Stability Analysis, Revision No. 2 – Neutralized Material  
**DATE:** October 28, 2002

Based on the laboratory strength data for the SECOR neutralization recipe for soil/sludge at the Purity Oil site, the slope stability analysis was revised to reflect the most current, anticipated design conditions. The majority of the design conditions previously analyzed in the slope stability analysis were unchanged. The only parameters changed for this analysis were the shear strengths specified for the “waste material.” A summary of the soil properties utilized in SECOR’s analysis is summarized in the following table.

Material Type	Wet Density (pcf)	Cohesion, C (psf)	Friction Angle, $\phi$ (degrees)
Vegetation Layer	120	0	28
GCL / Soil Interface	85	0	24
Foundation Layer	125	0	30
Waste Material	107	300	25
Native Sand	106	0	40

Under static and pseudo-static loading conditions, the risk of a global slope stability failure exceeds a safety factor of 1.5.

The minimum shear strength of the “waste material” required to provide an acceptable safety factor was also determined to quantify the risk at worst case scenarios. If no cohesion is developed in the SECOR neutralization recipe, the “waste material” still has an acceptable safety under static and pseudo-static loading, at a wet density of 107 pcf and a friction angle of 25 degrees. If a minimal friction angle of at least 5 degrees is developed in the SECOR neutralization recipe, the “waste material” still has an acceptable safety factor under static and pseudo-static loading, at a wet density of 107 pcf and cohesion of 300 pcf.

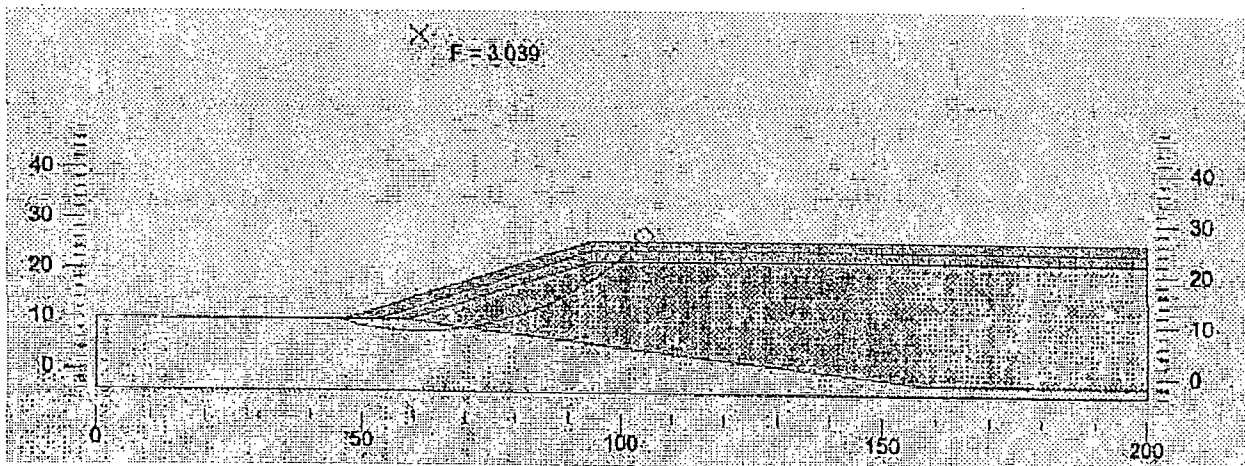
Even if the composition and the shear strength of the “waste material” varies during implementation of the site wide neutralization within the shear strength parameters specified above, the analysis described above indicates that there will be acceptable safety factors for slope stability under a variety of worst case shear strength scenarios.

**Enclosures:** Appendix A – Slope Stability Analyses

## APPENDIX A

	Gamma	C	Phi	Piezo	Ru
	pcf	psf	deg	Surf.	
Vegetation Layer	120	0	28	0	0
GCL Interface	85	0	24	0	0
Foundation Layer	125	0	30	0	0
Waste Material	107	300	25	0	0
Native Sand	106	0	40	0	0

Secor International Inc. - Redlands, CA  
 24CH.67001.00  
 Purity Oil Superfund  
 May 22, 2002  
 3:1 slope  
 Max waste slope height 12 feet

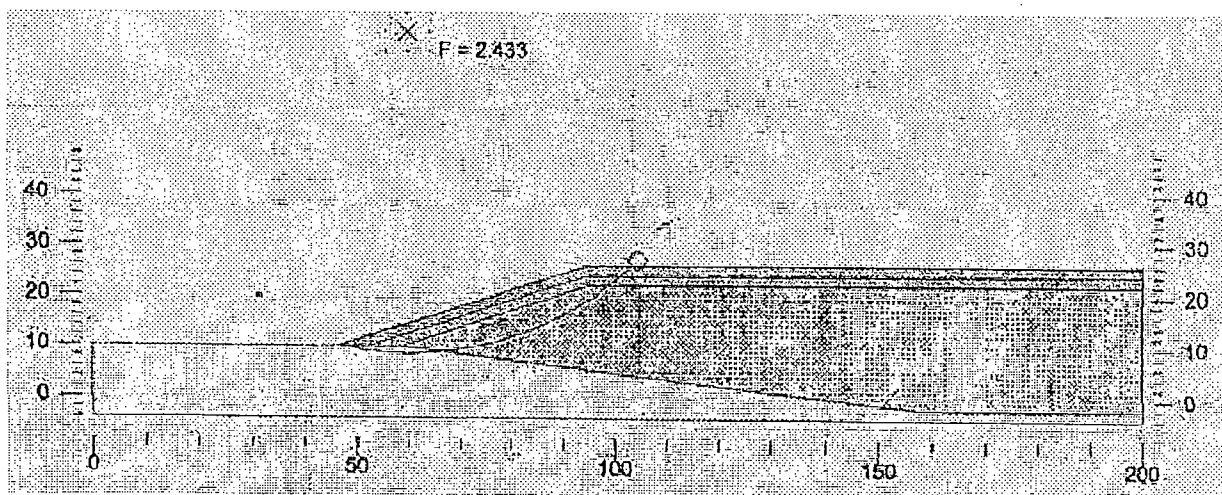


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	Gamma pcf	C psf	Phi deg	Piezo Surf.	Ru
Vegetation Layer	120	0	28	0	0
GCL Interface	85	0	24	0	0
Foundation Layer	125	0	30	0	0
Waste Material	107	300	25	0	0
Native Sand	106	0	40	0	0

Seismic coefficient = 0.07

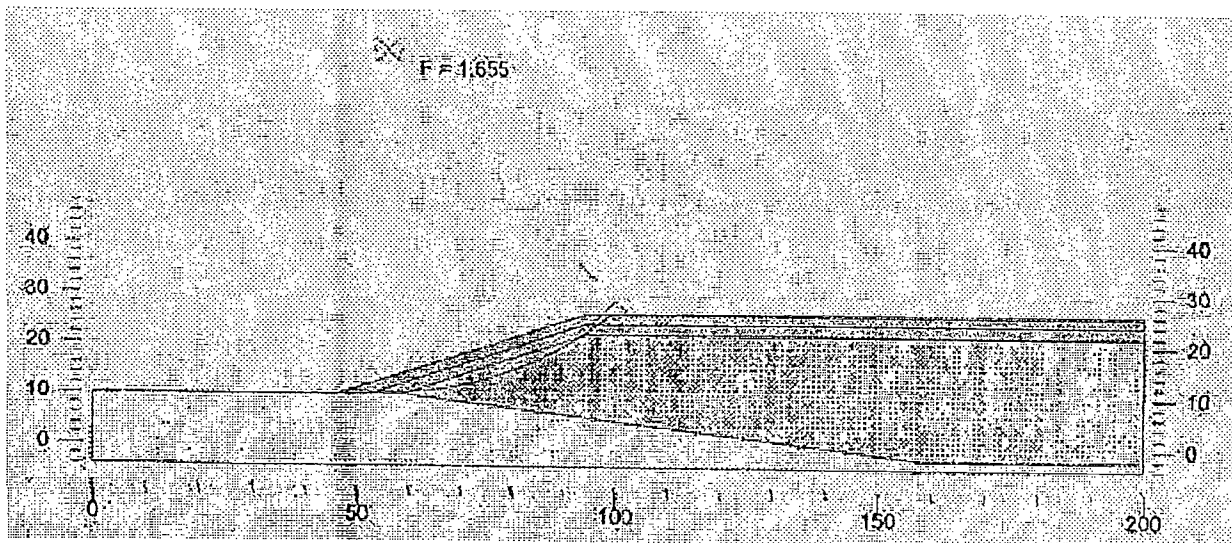
Secor International Inc. - Redlands, CA  
 24CH.67001.00  
 Purity Oil Superfund  
 May 22, 2002  
 3:1 slope  
 Max waste slope height 12 feet



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	Gamma	C	Phi	Piezo	Ru
	pcf	psf	deg	Surf.	
Vegetation Layer	120	0	28	0	0
GCL Interface	85	0	24	0	0
Foundation Layer	125	0	30	0	0
Waste Material	107	0	25	0	0
Native Sand	106	0	40	0	0

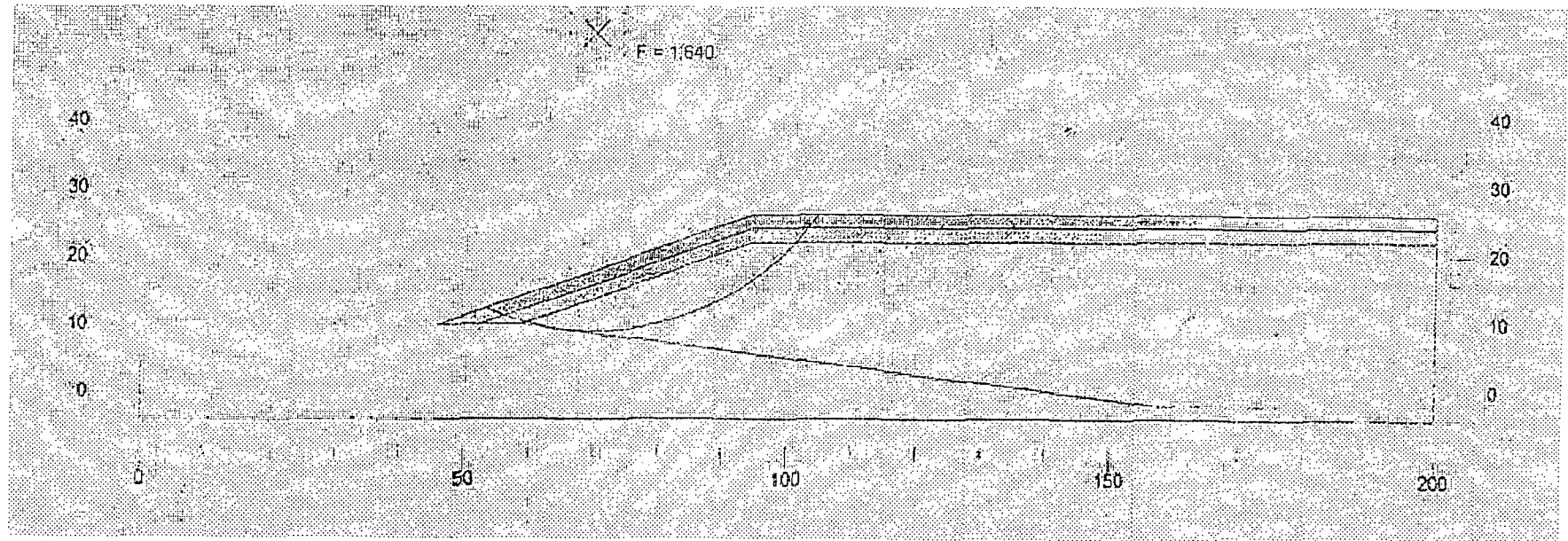
Secor International Inc. - Redlands, CA  
 24CH.67001.00  
 Purity Oil Superfund  
 May 22, 2002  
 3:1 slope  
 Max waste slope height 12 feet



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	Gamma pcf	C psf	Phi deg	Piezo Surf.	Ru
Vegetation Layer	120	0	28	0	0
GCL Interface	85	0	24	0	0
Foundation Layer	125	0	30	0	0
Waste Material	107	275	5	0	0
Native Sand	106	0	40	0	0

Secor International Inc. - Redlands, CA  
 24CH.67001.00  
 Purity Oil Superfund  
 May 22, 2002  
 3:1 slope  
 Max waste slope height 12 feet



## MEMORANDUM

To: Scott Jordan, SECOR International, Inc.  
From: Thomas Cole, SECOR International Inc.  
Subject: Neutralized Sludge Mixes for Purity Oil Sales Site  
Date: November 21, 2002  
cc: Jim Burns, Gary Cameron, Craig Skiera, Todd Shibata, Dan Oberle

---

Scott,

SECOR has completed geotechnical testing for the neutralized material at the Purity Oil Sales Superfund site in Malaga, California. The site-wide neutralization recipe is expected to consist of approximately 9% calcium carbonate, 23% sludge material, and 68% sandy soil, by weight. Varying conditions within the subsurface may require adjustments to this recipe in localized areas.

To better facilitate neutralization operations at the site, soil, sludge, and debris will be excavated and transported to an isolated mixing area. During excavation, debris larger than 24 inches will be segregated from the sludge and soil materials and stockpiled for disposal. When appropriate amounts of soil and sludge have been transported to the mixing area, they will be combined with the calcium carbonate in the correct proportions to produce a neutralized mixture that can be compacted to achieve the minimum strength parameters required by the slope stability analysis. Once the operator believes that the recipe has been thoroughly mixed, the batch will be sampled and tested to determine its pH and achievable dry density.

The pH testing will be performed on three discrete samples from each batch to verify that the material has a pH above five. A single point density test using the standard compactive effort Proctor test procedures (ASTM 698) will also be conducted to assess the material's ability to achieve adequate dry density during placement and compaction. One neutralized sample will be tested to verify that the neutralized material meets a minimum dry density of 100 pcf and has a water content that is within 3% of optimum.

The minimum dry density value was established from the slope stability analysis (see Attachment 1) and the standard effort Proctor test results, (see Attachment 2). The wet unit weight of the waste material used in the model was 107 pcf and the optimal water content for the neutralized waste is approximately 8 percent, resulting in a corresponding dry unit weight of 99 pcf. Establishing a minimum dry density of 100 pcf for the single point test ensures that the material is capable of achieving adequate in-place density. The type of waste material encountered in the subsurface is anticipated to vary from one portion of the site to another and one moisture-density curve is unlikely to be representative for all locations. If the single point analyses begin to vary from the moisture-density curve established by the original Proctor test, additional five point tests will be performed when appropriate.

When the material meets the pH and compaction specifications, it will be transported back to the excavated area, placed in eight inch lifts, and compacted using a padded foot roller. The roller will make four passes over the placed material to ensure adequate compaction of the neutralized waste

materials. Following placement and compaction, in-place field density test methods will be evaluated to determine if the amended waste materials exhibit consistent compaction characteristics. Previous efforts have demonstrated in-place density testing to be inconsistent due to large pieces of debris, pockets of hydrocarbon sludge, and the heterogeneity of the waste material. During excavation, mixing, and replacement of the amended waste materials, SECOR recognizes that the waste materials may become increasingly homogenous and in-place density testing may produce more predictable results.

When the roller has completed compacting each lift, one nuclear gage test (ASTM D 2922), one drive cylinder test (ASTM D 2937), and one sand cone test (ASTM D 1556) will be conducted on each lift. This data will be compiled and analyzed to determine whether the tests produce consistent results after the waste material has been subjected to a consistent compactive effort. If the data generated from the tests is determined to be consistent enough to predict the relative compaction of the waste material, they may be used as a quality control tool during full scale operations. If the data exhibits excessive scatter following consistent compactive effort, the waste materials will be compacted in place and proof-rolled to demonstrate that undo deflection does not occur.

SECOR has completed unconfined and triaxial compression testing (ASTM D 2166 and ASTM D 2850) for the neutralized waste, and a strength envelope for the material is provided in Attachment 3. The anticipated cohesion and friction angle values are 300 psf and 25 degrees, respectively. The factor of safety for these conditions exceeds 2.4.

Due to the heterogeneity of the subsurface materials, the strength parameters for the neutralized waste may vary from one portion of the site to another. During pilot test operations, three additional samples will be collected from the neutralized waste for triaxial compression testing. The samples will be collected from portions of the site where the visual appearance of the subsurface materials appears to differ from those areas already tested. The results from all of the tests will be analyzed individually to establish the worst-case strength parameters and combined to create a composite strength parameters. Slope stability analyses for each situation will then be performed to establish appropriate factors of safety.

Please contact me at (231) 348-9822 if you have any questions regarding this memorandum.

Tom



# MEMORANDUM

**TO:** Tom Cole  
**FROM:** Todd Shibata  
**SUBJECT:** CHEVRON – PURITY OIL SITE  
Slope Stability Analysis, Revision No. 2 – Neutralized Material  
**DATE:** October 28, 2002

Based on the laboratory strength data for the SECOR neutralization recipe for soil/sludge at the Purity Oil site, the slope stability analysis was revised to reflect the most current, anticipated design conditions. The majority of the design conditions previously analyzed in the slope stability analysis were unchanged. The only parameters changed for this analysis were the shear strengths specified for the “waste material.” A summary of the soil properties utilized in SECOR’s analysis is summarized in the following table.

Material Type	Wet Density (pcf)	Cohesion, $C$ (psf)	Friction Angle, $\phi$ (degrees)
Vegetation Layer	120	0	28
GCL / Soil Interface	85	0	24
Foundation Layer	125	0	30
Waste Material	107	300	25
Native Sand	106	0	40

Under static and pseudo-static loading conditions, the risk of a global slope stability failure exceeds a safety factor of 1.5.

The minimum shear strength of the “waste material” required to provide an acceptable safety factor was also determined to quantify the risk at worst case scenarios. If no cohesion is developed in the SECOR neutralization recipe, the “waste material” still has an acceptable safety under static and pseudo-static loading, at a wet density of 107 pcf and a friction angle of 25 degrees. If a minimal friction angle of at least 5 degrees is developed in the SECOR neutralization recipe, the “waste material” still has an acceptable safety factor under static and pseudo-static loading, at a wet density of 107 pcf and cohesion of 300 pcf.

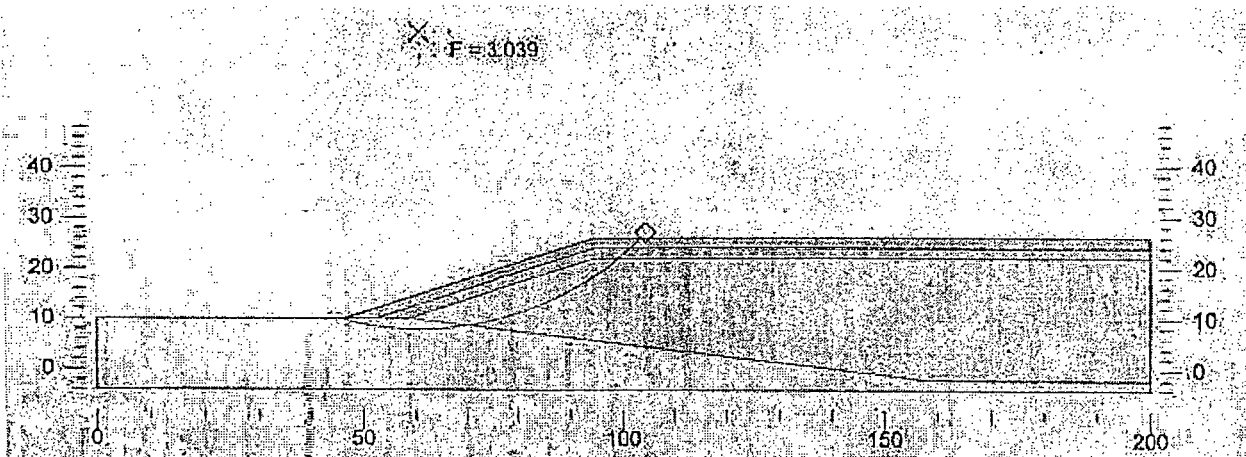
Even if the composition and the shear strength of the “waste material” varies during implementation of the site wide neutralization within the shear strength parameters specified above, the analysis described above indicates that there will be acceptable safety factors for slope stability under a variety of worst case shear strength scenarios.

**Enclosures:** Appendix A – Slope Stability Analyses

## APPENDIX A

	Gamma pcf	C psf	Phi deg	Piezo Surf.	Ru
Vegetation Layer	120	0	28	0	0
GCL Interface	85	0	24	0	0
Foundation Layer	125	0	30	0	0
Waste Material	107	300	25	0	0
Native Sand	106	0	40	0	0

Secor International Inc. - Redlands, CA  
 24CH.67001.00  
 Purity Oil Superfund  
 May 22, 2002  
 3:1 slope  
 Max waste slope height 12 feet

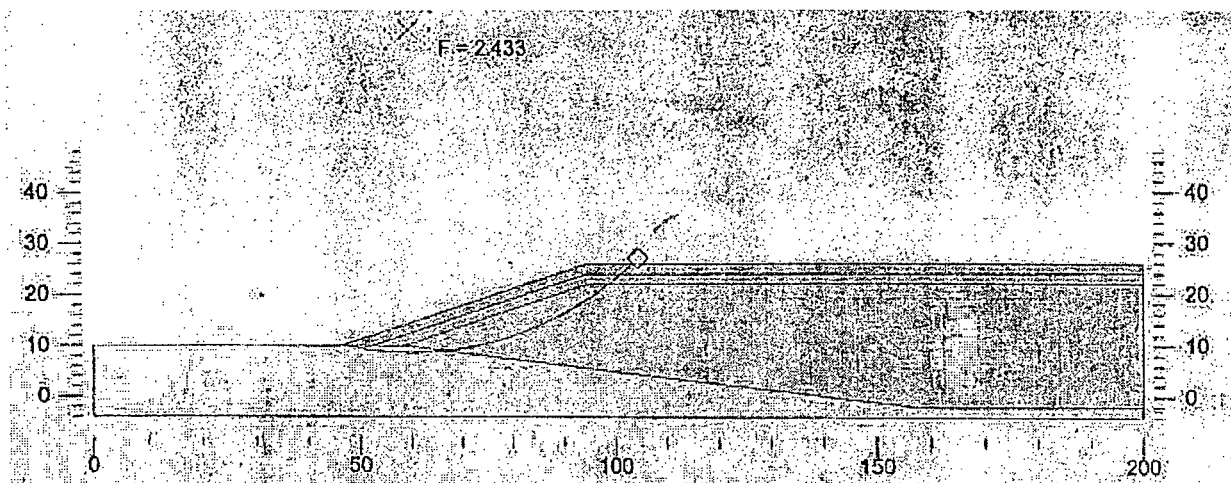


10/25/2002 1:51:34 PM I:\CHEVRON\PURITY-1\WW2S.GSL Secor International Inc. - Redlands, CA F = 3.039

	Gamma	C	Phi	Piezo	Ru
	pcf	psf	deg	Surf.	
Vegetation Layer	120	0	28	0	0
GCL Interface	85	0	24	0	0
Foundation Layer	125	0	30	0	0
Waste Material	107	300	25	0	0
Native Sand	106	0	40	0	0

Seismic coefficient = 0.07

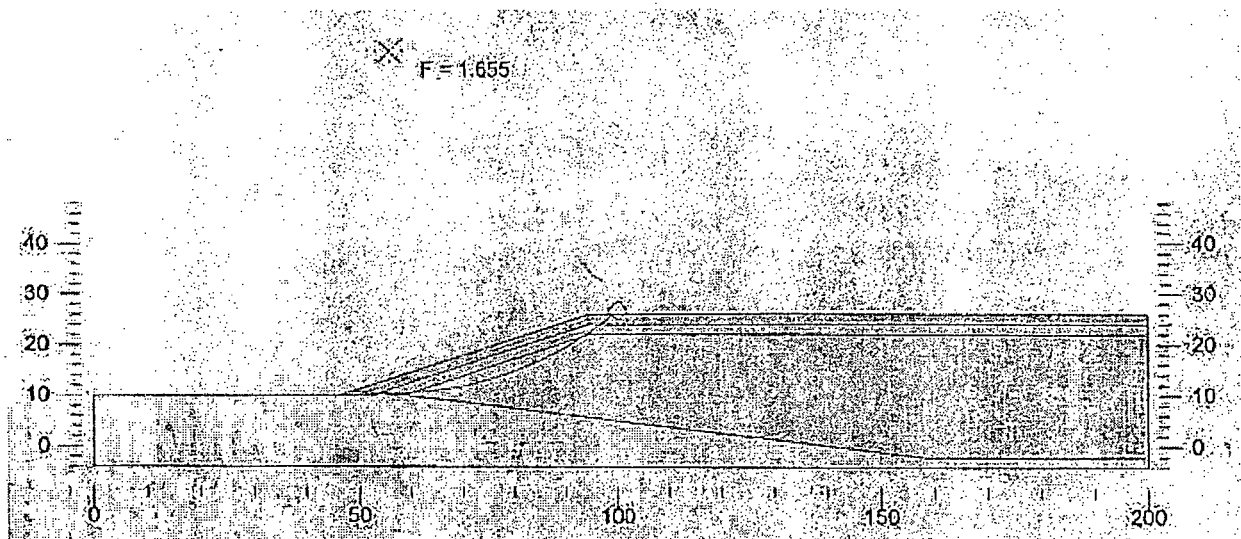
Secor International Inc. - Redlands, CA  
 24CH.67001.00  
 Purity Oil Superfund  
 May 22, 2002  
 3:1 slope  
 Max waste slope height 12 feet



10/25/2002 1:56:35 PM I:\CHEVRONPURITY-1\WW2PS.GSL Secor International Inc. - Redlands, CA F = 2.433

	Gamma pcf	C psf	Phi deg	Piezo Surf.	Ru
Vegetation Layer	120	0	28	0	0
GCL Interface	85	0	24	0	0
Foundation Layer	125	0	30	0	0
Waste Material	107	0	25	0	0
Native Sand	106	0	40	0	0

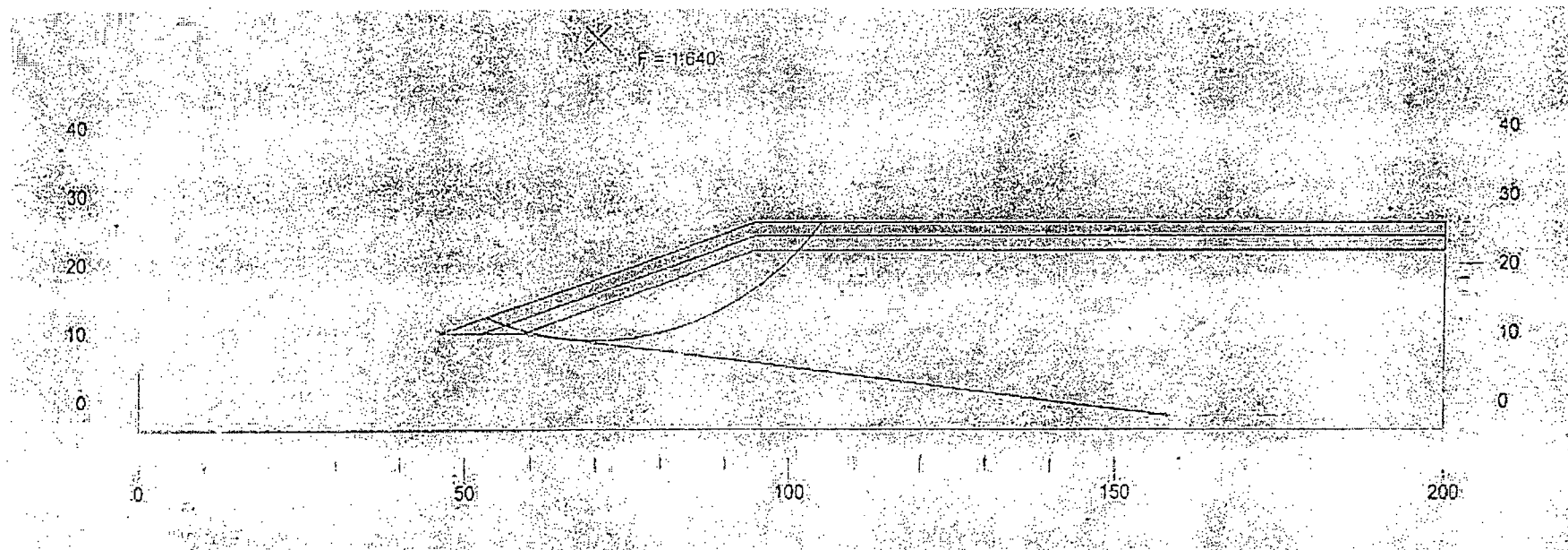
Secor International Inc. - Redlands, CA  
 24CH.67001.00  
 Purity Oil Superfund  
 May 22, 2002  
 3:1 slope  
 Max waste slope height 12 feet



10/25/2002 2:13:13 PM I:\CHEVRON\PURITY-1\NW3S.GSL Secor International Inc. - Redlands, CA F = 1.655

	Gamma pcf	C psf	Phi deg	Piezo Surf.	Ru
Vegetation Layer	120	0	28	0	0
GCL Interface	85	0	24	0	0
Foundation Layer	125	0	30	0	0
Waste Material	107	275	5	0	0
Native Sand	106	0	40	0	0

Secor International Inc. - Redlands, CA  
 24CH.67001.00  
 Purity Oil Superfund  
 May 22, 2002  
 3:1 slope  
 Max waste slope height 12 feet



**SECOR**  
**International Incorporated**  
 Geotechnical Laboratory  
 2321 Club Meridian Drive  
 Suite E  
 Okemos, MI 48864

Client/Project:	Chevron/Purity Oil
Job No.:	24CH.67001.00
Task:	0006
Sample ID:	SECOR Mix
Tested By:	TC
Date:	9/10/02

**MOISTURE/DENSITY RELATIONS FOR GRANULAR SOILS (ASTM D 698)**

Standard Compactive Effort Using 5.5 lb Hammer and 4" Mold

Soil Description:

Brown silty sand with gravel, sludge, and CaCO<sub>3</sub>.

**Standard Proctor Compaction Test**

**Initial Soil Data**

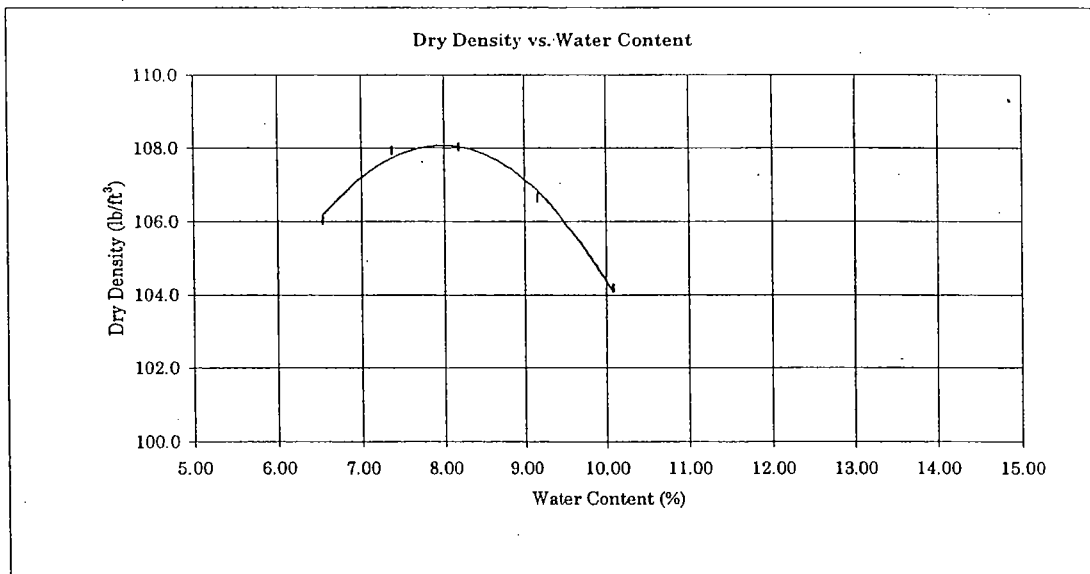
Mass of Tare	1.43	grams
Mass of Soil	50.86	grams
Mass of Soil	46.95	grams
Mass of Water	3.91	grams
Initial Water Content	8.33	%

**Compaction Mold Data**

Mass of Mold	4616	grams
Volume of Mold	0.0009	m <sup>3</sup>

**Compaction Data**

Target Water (%)	Water Added (grams)	Mold & Material (grams)	Wet Material (grams)	Wet Density (Mg/m <sup>3</sup> )	Tare Mass (grams)	Tare + Soil (grams)	Tare + Soil (grams)	Actual Water (%)	Dry Density (Mg/m <sup>3</sup> )	Dry Density (lb/ft <sup>3</sup> )
6	0.0	6325	1709	1.81	1.30	59.24	55.69	6.53	1.70	106.0
7	25.0	6369	1753	1.86	1.31	45.20	42.19	7.86	1.73	107.9
8	25.0	6384	1768	1.87	1.29	44.56	41.29	8.18	1.73	108.0
9	25.0	6377	1761	1.87	1.30	46.87	43.05	9.15	1.71	106.6
10	25.0	6351	1735	1.84	1.31	48.61	44.28	10.08	1.67	104.2

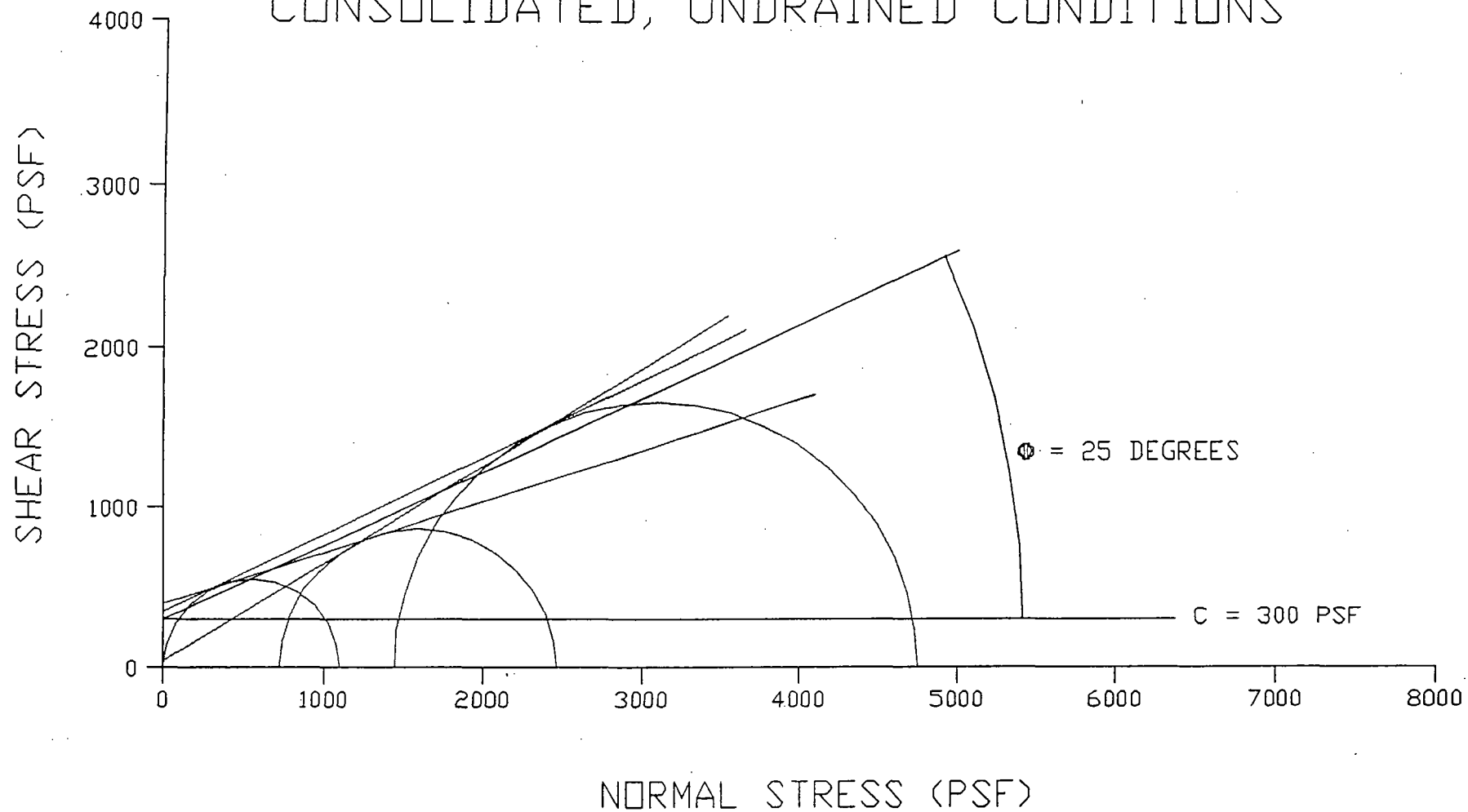


<b>Maximum Dry Density</b>	
(Mg/m <sup>3</sup> )	(lb/ft <sup>3</sup> )
1.73	108.1

<b>Optimum Water Content (%)</b>	
8.0	

Comments:

SÉCOR MIX  
CONSOLIDATED, UNDRAINED CONDITIONS





**APPENDIX C**  
**FIELD NEUTRALIZATION DATA**

**SECOR International, Inc.**  
2321 Club Meridian Drive, Ste. E  
Okemos, MI 48864

**QAQC Neutralization Data Summary**

Date Sampled	Test ID Number	Grid Location	Excavation Depth	Sludge Thickness	Acidity (%)	Sludge (tons)	CaCO <sup>3</sup> (tons)	Soil (tons)	Res. Time (hours)	Final pH	WC (%)	Y <sub>bulk</sub> (lb/ft <sup>3</sup> )
4/22/03	PTA1-1	B-5.5	0'-2'	0.25'-2'	1.2	42.5	5.3	129	6.0	6.7	11.1	118.0
4/23/03	PTA1-2	AB-5.5	0'-2'	0.25'-2'	0.74	42.5	3.5	145	4.0	6.8	10.2	116.0
4/23/03	PTA1-3	AB-5	0'-3'	1.5'-3'	2.6	42.5	5.0	146	2.3	6.8	14.4	116.2
4/24/03	PTA1-4	B-5.5	0'-3.5'	1'-3.5'	6.3	42.5	5.3	137	3.8	6.7		
4/24/03	PTA1-5	B-5	0'-4.5'	1'-4.5'	5.5	42.5	4.5	145	17.0	6.8	14.5	117.4
4/25/03	PTA2-1	OP-3	0'-10'	2'-10'	0.5-16.6	42.5	3.3	145	66.0	6.9		
4/28/03	PTA3-1	ST-5	0'-13'	4'-12'	0.75	42.5	3.1	138	3.5	6.6		
4/28/03	PTA1-6	BC-5.5	0'-5'	1.5'-5'	7.7	42.5	6.3	139	15.7	6.2		
4/28/03	PTA1-7	BC-5	0'-5'	1'-5'	3.5	42.5	4.8	144	6.0	5.7		
4/29/03	PTA1-8	BC-5	0'-5'	1'-5'	4.2	42.5	6.4	143	28.2	5.6		
4/30/03	PTA1-9a	C-5	0'-5.5'	1'-5'	3.5	42.5	12.0	142	23.0	5.3		
5/1/03	PTA1-9b	C-5	0'-5.5'	1'-5'	4.8	42.5	4.8	143	16.3	6.2		
5/2/03	PTA1-9c	C-5	0'-5.5'	1'-5'	3.6	64	10.9	120	70.0	6.5	10.9	119.6
5/5/03	PTA1-9d	CD-4,6	0'-8'	1'-7'	8.3	64	16.6	118	5.0	5.4		
5/5/03	PTA1-9e	CD-4,6	0'-8'	1'-7'	7.2	64	15.0	121	17.0	6.3		
5/6/03	PTA1-9f	CD-4,6	0'-8'	1'-7'	3.0	64	7.8	108	21.7	7.5		
5/7/03	PTA1-9g	CD-4,6	0'-8'	1'-7'	5.6	64	7.8	118	3.5	6.9		
5/7/03	PTA1-9h	CD-4,6	0'-8'	1'-7'	5.0	64	8.1	118	2.5	6.9		
5/14/03	PTA1-9i	CD-4,6	0'-8'	1'-7'	3.3	64	6.0	94	2.8	5.4		
5/14/03	PTA1-9j	CD-4,6	0'-8'	1'-7'	3.3	64	6.0	94	4.0	6.4		
5/14/03	PTA1-9k	CD-4,6	0'-8'	1'-7'	4.2	64	5.9	98	3.0	5.4		
5/15/03	PTA1-9l	CD-4,6	0'-8'	1'-7'	4.6	64	5.9	98	16.0	5.4		
5/15/03	PTA1-9m	CD-4,6	0'-8'	1'-7'	4.1	64	6.4	115	4.5	7.0		
5/15/03	PTA1-9n	CD-4,6	0'-8'	1'-7'	4.0	64	8.0	115	4.0	6.2		
5/15/03	PTA1-9o	CD-4,6	0'-8'	1'-7'	5.2	64	8.1	114	2.8	6.2		
5/16/03	PTA1-9p	CD-4,6	0'-8'	1'-7'	4.5	64	8.9	108	2.5	5.3		
5/16/03	PTA1-9q	CD-4,6	0'-8'	1'-7'	4.3	64	8.9	108	5.0	5.2		
5/16/03	PTA1-9r	CD-4,6	0'-8'	1'-7'	4.5	64	8.4	110	16.0	6.6		
5/19/03	PTA1-9s	CD-4,6	0'-8'	1'-7'	3.7	76	7.3	136	4.5	5.5		
5/19/03	PTA1-10a	D-4.5,6	0-11'	3'-10'	2.6	64	7.5	112	28.8	5.5		
5/20/03	PTA1-10b	D-4.5,6	0-11'	3'-10'	9.9	64	13.6	108	6.2	6.6		
5/20/03	PTA1-10c	D-4.5,6	0-11'	3'-10'	4.0	64	6.1	108	20.5	7.0		
5/21/03	PTA1-10d	D-4.5,6	0-11'	3'-10'	3.9	64	7.3	114	5.0	6.6		
5/21/03	PTA1-10e	D-4.5,6	0-11'	3'-10'	2.7	128	12.3	275	17.0	5.6		
5/28/03	PTA1-10f	D-4.5,6	0-11'	3'-10'	7.4	85	11.8	187	5.0	5.4		
5/28/03	PTA1-10g	D-4.5,6	0-11'	3'-10'	2.2	255	11.4	560	4.5	5.1		
5/29/03	PTA1-11	D-5	0-12'	3'-11'	13.6	85	22.8	187	3.0	5.9		
5/29/03	PTA1-12	D-4.5	0'-12'	3'-11'	2.7-11.7	255	27.2	577	24.0	5.2		
6/2/03	PTA1-13	DE-5.5	0-12'	3'-11'	10.8	255	44.8	610	4.5	6.6		
6/2/03	PTA1-14	DE-5	0'-12'	3'-11'	7.0	255	31.4	542	4.0	6.0		
6/3/03	PTA1-15	DE-5	0-12'	3'-11'	10.9	255	36.2	541	5.5	6.5		
6/4/03	PTA1-16	E-5.5	0'-12'	3'-11'	4.2	255	35.9	546	6.5	5.4		
6/4/03	PTA1-17	E-5	0'-12'	3'-11'	7.0	255	31.4	546	24.0	6.6		
6/5/03	PTA1-18	E-4.5	0-12'	3'-11'	4.3	255	24.8	512	25.0	6.2		
6/5/03	PTA1-19	EF-5.5	0-13'	4'-12'	3.7	255	19.9	512	97.0	6.3		
6/10/03	PTA4-1	KL-5.5	0-10'	3'-10'	8.8	85	14.3	182	3.0	9.2		
6/11/03	PTA1-20	EF-5	0-13'	4'-12'	2.8	255	29.8	551	3.5	6.1		
6/11/03	PTA1-21	EF-5	0-13'	4'-12'	6.4	255	29.8	551	5.0	6.5		
6/11/03	PTA1-22	EF-4.5	0-13'	4'-12'	14.8	191	50.5	396	4.0	6.3		
6/11/03	PTA1-23	F-6	0-13'	4'-12'	7.6	191	30.3	396	4.5	6.2		
6/13/03	PTA1-24	F-5.5	0-12'	5'-11'	3.8	191	30.8	421	3.5	5.7		
6/16/03	PTA5-1	T-6	0-12'	--	Found little sludge, just impacted soils. Did not mix a batch.							
6/16/03	PTA1-25	F-5.5	0-12'	5'-11'	6.0	128	18.2	298	2.2	5.0		
6/16/03	PTA1-26	F-5	0-12'	4'-11'	3.3	128	18.2	298	2.7	5.4		
6/17/03	PTA1-27	F-5	0'-12'	5'-11'	3.3	128	27.5	276	5.1	6.4		
6/17/03	PTA1-28	F-4.5	0'-12'	5'-11'	7.0	128	18.4	207	4.8	5.8		
6/18/03	PTA1-29	FG-5.5	0-12'	5'-11'	3.3	85	12.4	175	2.0	6.1		
6/18/03	PTA1-30	FG-5.5	0-12'	5'-11'	6.5	85	12.4	88	2.5	5.9		

AVERAGE = 5.2      110.7      14.9      236.2      12.3      6.2  
TOTAL = 6309.0      846.7      13465.0      699.9

**APPENDIX D**  
**IN PLACE DENSITY DATA**

**SECOR International, Inc.**  
2321 Club Meridian Drive, Ste. E  
Okemos, MI 48864

**QAQC Compaction Data Summary**

Date Sampled	Test ID Number	Grid Location	Lift or Depth	Elevation (ft,msl)	Test Method	Applicable Proctor	$\gamma_{bulk}$ (lb/ft <sup>3</sup> )	w.c. (%)	$\gamma_{dry}$ (lb/ft <sup>3</sup> )	Compaction (%)	1-PT Proctor Tests	
											w.c.	$\gamma_{bulk}$
											(%)	(lb/ft <sup>3</sup> )
4/29/03	PTA1-5a-NG	B-5.5	#2	287.6	Nuc. Gauge	NA	116.7	23.4	94.5	109.1	14.5	117.4
4/29/03	PTA1-5a-DC	B-5.5	#2	287.6	Drive Cyl.	NA	113.8	11.5	102.1	106.4		
4/29/03	PTA1-5b-NG	AB-5.5	#2	287.6	Nuc. Gauge	NA	114.8	24.4	92.0	107.3		
4/29/03	PTA1-5b-DC	AB-5.5	#2	287.6	Drive Cyl.	NA	110.1	10.1	100.0	102.9		
4/29/03	PTA1-5c-NG	B-5	#2	287.8	Nuc. Gauge	NA	120.6	21.0	99.7	112.7		
4/29/03	PTA1-5c-DC	B-5	#2	287.8	Drive Cyl.	NA	114.1	11.4	102.4	106.6		
4/29/03	PTA1-5d-NG	AB-5.5	#2	287.7	Nuc. Gauge	NA	119.5	23.7	96.6	111.7		
4/29/03	PTA1-5d-DC	AB-5.5	#2	287.7	Drive Cyl.	NA	110.2	11.9	98.5	103.0		
4/29/03	PTA1-5d-SC	AB-5.5	#2	287.7	Sand Cone	NA	111.3	11.8	99.6	104.0		
4/29/03	PTA1-5e-NG	AB-5	#2	287.7	Nuc. Gauge	NA	121.8	21.9	99.9	113.8		
4/29/03	PTA1-5e-DC	AB-5	#2	287.7	Drive Cyl.	NA	107.4	10.6	97.1	100.4		
4/29/03	PTA1-5f-NG	B-5.5	#3	288.1	Nuc. Gauge	NA	119.4	23.3	96.9	111.6		
4/29/03	PTA1-5f-DC	B-5.5	#3	288.1	Drive Cyl.	NA	112.9	12.6	100.3	105.5		
4/29/03	PTA1-5f-SC	B-5.5	#3	288.1	Sand Cone	NA	124.7	11.7	111.6	116.5		
4/29/03	PTA1-5g-NG	AB-5	#3	288.2	Nuc. Gauge	NA	120.5	22.2	98.6	112.6		
4/29/03	PTA1-5g-DC	AB-5	#3	288.2	Drive Cyl.	NA	115.9	11.6	103.9	108.3		
4/29/03	PTA1-5g-SC	AB-5	#3	288.2	Sand Cone	NA	121.7	10.4	110.2	113.7		
4/29/03	PTA1-5h-NG	B-4.5	#3	288.4	Nuc. Gauge	NA	116.9	20.2	97.4	109.2		
4/29/03	PTA1-5h-DC	B-4.5	#3	288.4	Drive Cyl.	NA	110.5	10.7	99.8	103.3		
5/1/03	PTA1-3a-NG	B-5	#3	288.5	Nuc. Gauge	NA	116.4	17.0	99.5	108.8	14.4	116.2
5/1/03	PTA1-3a-DC	B-5	#3	288.5	Drive Cyl.	NA	115.3	9.9	104.9	107.8		
5/1/03	PTA1-3a-SC	B-5	#3	288.5	Sand Cone	NA	126.5	10.2	114.8	118.2		
5/1/03	PTA1-3b-NG	B-5.5	#3	288.5	Nuc. Gauge	NA	119.7	14.8	104.3	111.9		
5/1/03	PTA1-3b-DC	B-5.5	#3	288.5	Drive Cyl.	NA	120.9	9.9	110.0	113.0		
5/1/03	PTA1-3b-SC	B-5.5	#3	288.5	Sand Cone	NA	127.1	10.4	115.1	118.8		
5/1/03	PTA1-3c-NG	BC-5.5	#2	287.9	Nuc. Gauge	NA	115.7	13.7	101.8	108.1		
5/1/03	PTA1-3c-DC	BC-5.5	#2	287.9	Drive Cyl.	NA	110.4	9.5	100.8	103.2		
5/1/03	PTA1-3d-NG	BC-5	#2	288.1	Nuc. Gauge	NA	117.9	14.6	102.9	110.2		
5/1/03	PTA1-3d-DC	BC-5	#2	288.1	Drive Cyl.	NA	112.2	9.6	102.4	104.9		
5/1/03	PTA1-3e-NG	BC-5	#2	288.0	Nuc. Gauge	NA	118.1	13.6	104.0	110.4		
5/1/03	PTA1-3e-DC	BC-5	#2	288.0	Drive Cyl.	NA	112.3	9.6	102.5	105.0		
5/1/03	PTA1-3f-NG	C-5	#1	287.8	Nuc. Gauge	NA	119.1	13.0	105.4	111.3		
5/1/03	PTA1-3f-DC	C-5	#1	287.8	Drive Cyl.	NA	117.9	9.5	107.7	110.2		
5/1/03	PTA1-3g-NG	BC-5.5	#2	288.0	Nuc. Gauge	NA	122.6	14.8	106.8	114.6		
5/1/03	PTA1-3g-DC	BC-5.5	#2	288.0	Drive Cyl.	NA	119.5	10.5	108.1	111.7		
5/1/03	PTA1-3h-NG	BC-4.5	#2	288.1	Nuc. Gauge	NA	117.4	16.0	101.3	109.7		
5/1/03	PTA1-3h-DC	BC-4.5	#2	288.1	Drive Cyl.	NA	119.4	9.1	109.4	111.6		
5/1/03	PTA1-3h-SC	BC-4.5	#2	288.1	Sand Cone	NA	120.4	10.4	109.1	112.5		
5/1/03	PTA1-1a-NG	C-5.5	#3	288.5	Nuc. Gauge	NA	117.6	14.6	102.7	109.9	11.1	118.0
5/1/03	PTA1-1a-DC	C-5.5	#3	288.5	Drive Cyl.	NA	118.2	9.8	107.7	110.5		
5/1/03	PTA1-1a-SC	C-5.5	#3	288.5	Sand Cone	NA	111.4	9.8	101.5	104.1		
5/1/03	PTA1-1b-NG	C-5	#3	288.5	Nuc. Gauge	NA	116.9	14.9	101.7	109.3		
5/1/03	PTA1-1b-DC	C-5	#3	288.5	Drive Cyl.	NA	115.2	9.5	105.2	107.7		
5/1/03	PTA1-1c-NG	B-5	#4	289.3	Nuc. Gauge	NA	113.7	20.3	94.5	106.3		
5/1/03	PTA1-1c-DC	B-5	#4	289.3	Drive Cyl.	NA	110.5	10.3	100.2	103.3		
5/1/03	PTA1-1d-NG	B-5.5	#4	289.2	Nuc. Gauge	NA	117.8	16.6	101.0	110.1		
5/1/03	PTA1-1d-DC	B-5.5	#4	289.2	Drive Cyl.	NA	118.2	9.2	108.2	110.5		
5/1/03	PTA1-1d-SC	B-5.5	#4	289.2	Sand Cone	NA	122.1	10.1	110.9	114.1		
5/1/03	PTA1-1e-NG	B-5.5	#4	289.4	Nuc. Gauge	NA	109.7	18.3	92.7	102.5		
5/1/03	PTA1-1e-DC	B-5.5	#4	289.4	Drive Cyl.	NA	110.5	9.9	100.5	103.3		
5/6/03	PTA1-2a-DC	BC-5	#4	289.2	Drive Cyl.	NA	117.3	11.5	105.2	109.6	10.2	116.0
5/6/03	PTA1-2a-SC	BC-5	#4	289.2	Sand Cone	NA	123.8	9.7	112.9	115.7		
5/6/03	PTA1-2b-DC	BC-5.5	#4	289.2	Drive Cyl.	NA	120.4	9.7	109.8	112.5		
5/7/03	PTA1-2c-DC	C-4.5	#1	287.1	Drive Cyl.	NA	120.9	9.6	110.3	113.0		
5/7/03	PTA1-2c-SC	C-4.5	#1	287.1	Sand Cone	NA	112.2	10.2	101.8	104.9		
5/7/03	PTA1-2d-DC	C-5.5	#1	286.9	Drive Cyl.	NA	119.8	9.7	109.2	112.0		
5/14/03	051403-a	C-5		287.9	Drive Cyl.	NA	117.6	10.6	106.3	109.9	10.9	119.6
5/14/03	051403-b	C-6		288.8	Drive Cyl.	NA	119.4	10.3	108.3	111.6		
5/15/03	051503-a	B-5		289.7	Drive Cyl.	NA	108.7	7.9	100.7	101.6		
5/15/03	051503-b	C-5.5		290.6	Drive Cyl.	NA	120.1	11.1	108.1	112.2	10.2	118.0
5/15/03	051503-c	C-5		291.3	Drive Cyl.	NA	111.3	11.6	99.7	104.0		

5/15/03	051503-d	BC-5		292.1	Drive Cyl.	NA	114.7	11.5	102.9	107.2	10.8	121.5
5/16/03	051603-a	C-5		292.6	Drive Cyl.	NA	113.1	11.4	101.5	105.7	10.3	116.8
5/30/03	053003-a	C-5		294.1	Drive Cyl.	NA	119.1	10.1	108.2	111.3	9.6	119.5
5/30/03	053003-b	D-5		287.7	Drive Cyl.	NA	110.1	8.8	101.2	102.9		
5/30/03	053003-c	C-5		288.7	Drive Cyl.	NA	116.5	10.4	105.5	108.9		
5/30/03	053003-d	C-5		289.6	Drive Cyl.	NA	119.8	10.7	108.2	112.0		
5/30/03	053003-e	C-5		290.5	Drive Cyl.	NA	118.6	10.0	107.8	110.8		
5/30/03	053003-f	C-5		291.7	Drive Cyl.	NA	109.0	11.0	98.2	101.9		
6/2/03	060203-a	CD-5.5		291.5	Drive Cyl.	NA	108.9	10.0	99.0	101.8	11.1	121.6
6/2/03	060203-b	CD-4.5		291.3	Drive Cyl.	NA	116.1	11.2	104.4	108.5		
6/2/03	060203-c	CD-5.5		292.4	Drive Cyl.	NA	116.7	10.8	105.3	109.1		
6/2/03	060203-d	C5		293.2	Drive Cyl.	NA	112.3	9.1	102.9	105.0		
6/5/03	060503-a	D-5		287.1	Drive Cyl.	NA	115.5	10.0	105.0	107.9	10.8	117.7
6/5/03	060503-b	D-5		287.7	Drive Cyl.	NA	118.2	11.0	106.5	110.5		
6/5/03	060503-c	D-6		288.6	Drive Cyl.	NA	119.8	9.0	109.9	112.0		
6/5/03	060503-d	D-4		289.6	Drive Cyl.	NA	114.0	9.8	103.8	106.5		
6/5/03	060503-e	D-5		290.9	Drive Cyl.	NA	115.3	8.6	106.2	107.8		
6/5/03	060503-f	D-5		291.5	Drive Cyl.	NA	115.8	9.8	105.5	108.2		
6/5/03	060503-g	CD-6		292.2	Drive Cyl.	NA	117.3	9.7	106.9	109.6		
6/6/03	060603-a	E-6		286.5	Drive Cyl.	NA	118.2	10.1	107.4	110.5	7.6	114.7
6/6/03	060603-b	E-4		287.8	Drive Cyl.	NA	112.3	9.7	102.4	105.0		
6/6/03	060603-c	E-6		288.7	Drive Cyl.	NA	114.7	9.9	104.4	107.2		
6/9/03	060903-a	E-4		289.7	Drive Cyl.	NA	114.9	9.3	105.1	107.4	9.1	118.8
6/9/03	060903-b	E-5		290.6	Drive Cyl.	NA	105.9	9.1	97.1	99.0		
6/9/03	060903-c	E-5		290.6	Drive Cyl.	NA	109.5	9.2	100.3	102.3		
6/9/03	060903-d	E-5		291.7	Drive Cyl.	NA	112.3	8.3	103.7	105.0		
6/9/03	060903-e	E-5		290.6	Drive Cyl.	NA	112.6	10.6	101.8	105.2		
6/9/03	060903-f	E-4		292.2	Drive Cyl.	NA	111.9	10.1	101.6	104.6		
6/9/03	060903-g	D-5		293.9	Drive Cyl.	NA	116.1	8.5	107.0	108.5		
6/9/03	060903-h	D-5		295.0	Drive Cyl.	NA	111.6	10.9	100.6	104.3		
6/13/03	061303-a	F-5		286.6	Drive Cyl.	NA	113.5	9.9	103.3	106.1	10.2	121.2
6/13/03	061303-b	F-4		287.5	Drive Cyl.	NA	115.2	10.8	104.0	107.7		
6/13/03	061303-c	F-6		288.4	Drive Cyl.	NA	114.0	10.2	103.4	106.5		
6/19/03	061903-a	F-6		286.9	Drive Cyl.	NA	109.3	7.4	101.8	102.1	9.1	123.4
6/19/03	061903-b	F-5		287.7	Drive Cyl.	NA	115.0	10.1	104.5	107.5		
									0.0	0.0		

AVERAGE = 115.9 11.9 102.6 107.2 10.7 118.7



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## California: Proposed Authorization of State Hazardous Waste Management Program Revision

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ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 271

[FRL-7000-2]

California: Proposed Authorization of State Hazardous Waste Management Program Revision

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

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SUMMARY: California has applied to EPA for final authorization of certain changes to its hazardous waste program under the Resource Conservation and Recovery Act (RCRA). EPA has reviewed California's application and made the tentative decision that these changes satisfy all requirements needed to qualify for final authorization, and is proposing to authorize the State's changes.

DATES: EPA must receive written comments on California's application for authorization for changes to its hazardous waste management program by July 20, 2001.

ADDRESSES: Send written comments to Rebecca Smith, WST-3, U.S. EPA Region 9, 75 Hawthorne Street, San Francisco, CA 94105-3901, Phone number (415) 744-2152. You can view and copy California's application at the following addresses: California Environmental Protection Agency, Environmental Services Center, 1001 I Street, First Floor, Sacramento, CA 95814, phone number: (916) 322-7394, from 8 a.m. to noon and 1 p.m. to 4 p.m., Monday through Friday (appointment preferred but not required); and EPA Region 9, Library, 75 Hawthorne Street, San Francisco, CA 94105-3901, phone number: (415) 744-1510, from 9 a.m. to 4 p.m. Copy services are not available in Sacramento, but should be arranged by the viewer.

FOR FURTHER INFORMATION CONTACT: Rebecca Smith at the above address and phone number.

SUPPLEMENTARY INFORMATION:

#### A. Why Are Revisions to State Programs Necessary?

States which have received final authorization from EPA under RCRA section 3006(b), 42 U.S.C. 6926(b), must maintain a hazardous waste program that is equivalent to, consistent with, and no less stringent than the Federal program. As the Federal program changes, states must change their programs and ask EPA to authorize the changes. Changes to state programs may be necessary when Federal or state statutory or regulatory authority is modified or when certain other changes occur. Most commonly, states must change their programs because of changes to EPA's regulations in 40 Code of Federal Regulations (CFR) parts 124, 260 through 266, 268, 270, 273 and 279.

#### B. What Decisions Have We Made in This Rule?

EPA has made the tentative determination that California's application to revise its authorized program meets all of the statutory and regulatory requirements established by RCRA. Therefore, we are proposing to grant California final authorization to operate its hazardous waste program with the changes described in the authorization application. California will have responsibility for permitting Treatment, Storage, and Disposal Facilities (TSDFs) within its borders (except in Indian Country) and for carrying out the aspects of the RCRA program described in its revised program application, subject to the limitations of the Hazardous and Solid Waste Amendments of 1984 (HSWA). New Federal requirements and prohibitions imposed by Federal regulations that EPA promulgates under the authority of HSWA take effect in authorized states before such states are authorized for the requirements. Thus, EPA will implement those requirements and prohibitions in California, including issuing permits, until the State is granted authorization to do so.

#### C. What Will Be the Effect if California Is Authorized for These Changes?

If California is authorized for these changes, a facility in California subject to RCRA will have to comply with the authorized State requirements in lieu of the corresponding Federal requirements in order to comply with RCRA. Additionally, such persons will have to comply with any applicable Federally-issued requirements, such as, for example, HSWA regulations issued by EPA for which the State has not received authorization, and RCRA requirements that are not supplanted by authorized state-issued requirements. California continues to have enforcement responsibilities under its State law to pursue violations of its hazardous waste management program. EPA continues to have independent authority under RCRA sections 3007, 3008, 3013, and 7003, which include, among others, the authority to:

- Do inspections, and require monitoring, tests, analyses or reports,

- Enforce RCRA requirements (including State-issued statutes and regulations that are authorized by EPA and any applicable Federally-issued statutes and regulations) and suspend or revoke permits, and

- Take enforcement actions regardless of whether the State has taken its own actions.

The action to approve these revisions would not impose additional requirements on the regulated community because the regulations for which California will be authorized are already effective under State law and are not changed by the act of authorization.

EPA cannot delegate the Federal requirements at 40 CFR Part 262,

Subparts E and H. Although California has adopted these requirements verbatim from the Federal regulations in Title 22 of the California Code of Regulations, sections 66260-66262, EPA will continue to implement those requirements.

D. What Happens If EPA Receives Comments That Oppose This Action?

If EPA receives comments that oppose this authorization, we will address those comments in a later final rule. You may not have another opportunity to comment. If you want to comment on

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this authorization, you must do so at this time.

F. What Has California Previously Been Authorized for?

California initially received final authorization on July 23, 1992, effective August 1, 1992 (57 FR 32726), to implement the RCRA hazardous waste management program. This "base program authorization" authorized California's RCRA program based on California statutory and regulatory provisions in effect as of December of 1990.

G. What Changes Are We Proposing?

On January 31, 2000, California submitted a final complete program revision application, seeking authorization of their changes in accordance with 40 CFR 271.21. We have made a tentative determination that California's hazardous waste program revisions satisfy all of the requirements necessary to qualify for final authorization. California has applied for many of the Federal changes to the RCRA program since it was authorized for the base program. The earliest of these Federal changes goes back to 1989. However, there are several changes to the Federal program which have been made since California's base program was authorized for which California has not yet applied for authorization. The major areas of changes for which California has not yet applied for authorization are: The used oil regulations; consolidated liability requirements; military munitions; phases three and four of the land disposal restrictions; and universal waste.

Since authorization of California's base program in 1992, California has submitted numerous packages to EPA relating to its efforts to seek authorization for updates to its program based on revisions to the Federal program. EPA has published a series of checklists to aid California and the other states in such efforts, (see EPA's RCRA State Authorization web page at <http://www.epa.gov/epaoswer/hazwaste/state/index.htm>). Each checklist generally reflects changes made to the Federal regulations pursuant to a particular Federal Register notice. California's submittals have been grouped into general categories (e.g., Air Emissions Standards, Boilers and Industrial Furnaces, etc.). Each submittal may have reflected changes based on one or more Federal Register notices and would have thus referenced one or more corresponding checklists.

What follows is a summary, for each general category identified by California in its submittals, of the specific subjects of changes to the Federal program for that category. Although the changes to the Federal program are identified in the summary, California did not necessarily make revisions to its program as a result of each Federal revision noted. For example, certain revisions to the Federal program may have resulted in less stringent regulation than that which previously existed. Since states may maintain programs which are more stringent than the Federal program, states have the option whether or



not to adopt such revisions.

1. Changes California Identified as Relating to Air Emissions Standards

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program in the following areas: Organic air emission standards for process vents and equipment leaks; and organic air emissions standards for tanks, surface impoundments and containers.

2. Changes California Identified as Relating to the Toxicity Characteristic

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program in the following areas: Interim status standards for down-gradient ground-water monitoring well locations; hydrocarbon recovery operations; chlorofluorocarbon refrigerants; the mining waste exclusion; the recycled coke by-product exclusion; the toxicity characteristic leaching procedure; the mixture and derived-from rules; the removal of strontium sulfide from the list of hazardous wastes; the adoption of an administrative stay for K069 listing (emission control dust/sludge from secondary lead smelting); the adoption of certain technical corrections to the 1990 toxicity characteristic rule; the listing of chlorinated toluene production waste (K149, K150, K151); the standards for treating liquids in landfills; the references which specify testing requirements and monitoring activities; the listing of hazardous constituents from the use of chlorophenolic formulations in wood surface protection; the reference relating to wood surface protection; the listing of beryllium powder (P015); and provisions to be met for excluding as a hazardous waste certain wastewaters from the production of carbamates and carbamoyl oximes (K157).

3. Changes California Identified as Relating to Corrective Action Management

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program in the following areas: Corrective action management units and temporary units.

If these changes are authorized, they will include final authorization of California for the February 16, 1993 Corrective Action Management Unit (CAMU) rule. If California is authorized for the rule, the State will be eligible for interim authorization-by-rule for the proposed amendments to the CAMU rule, which also proposed the interim authorization-by-rule process (see August 22, 2000, 65 FR 51080, 51115). California will also become eligible for conditional authorization if that alternative is chosen by EPA in the final CAMU amendments rule.

4. Changes California Identified as Relating to Boilers and Industrial Furnaces

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program in the following areas: Burning of hazardous waste in boilers and industrial furnaces; an administrative stay for coke ovens; the recycled coke by-products exclusion; certain coke by-products listings; guidelines for air quality modeling and screening for boilers and industrial furnaces burning hazardous waste; the adoption of an administrative stay and interim standards for Bevill residues; and

certain technical amendments to record keeping instructions.

5. Changes California Identified as Relating to Wood and Sludge

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program in the following areas: Wood preserving listings; and petroleum refinery primary and secondary oil/water/solids separation sludge listings.

We also propose to find that California did not need to adopt a Federal administrative stay for the requirement that existing drip pads be impermeable because the stay expired on October 30, 1992.

6. Changes California Identified as Relating to Liners and Leak Detection

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program in the

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following area: Liners and leak detection systems for hazardous waste land disposal units.

7. Changes California Identified as Relating to Recyclable Materials Used in a Manner Constituting Disposal

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program in the following area: The removal of the conditional exemption for certain slag residues.

8. Changes California Identified as Relating to Recovered Oil

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program in the following area: The recovered oil exclusion.

9. Changes California Identified as Relating to Delay of Closure

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program in the following area: The delay of closure period for hazardous waste management facilities.

10. Changes California Identified as Relating to Public Participation

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program in the following area: Expanded public participation.

11. Changes California Identified as Relating to Used Oil Filters

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program in the following area: The used oil filter exclusion.

12. Changes California Identified as Relating to Land Disposal Restrictions (LDR)

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program in the following areas: LDR third third scheduled wastes; electric arc furnace dust (K061); LDRs for newly listed wastes and hazardous debris; LDRs for ignitable and corrosive characteristic wastes whose treatment standards were vacated; case-by-case capacity variances for hazardous debris; case-by-case capacity variances for lead-bearing hazardous materials; case-by-case capacity variances for hazardous soil; and universal treatment standards and treatment standards for organic characteristic wastes and newly listed wastes.

13. Changes California Identified as Relating to Exports

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program in the following area: The identification of the U.S. EPA office to which the notification of export activities and annual export reports must be sent. California has also adopted the Federal regulations implementing a graduated system of procedural and substantive controls for hazardous wastes as they move across national borders within the Organization for Economic Cooperation and Development (OECD) for recovery. The requirements for regulating exports, Subparts E and H of 40 CFR Part 262, will be administered by the U.S. EPA instead of California because the exercise of foreign relations and international commerce powers is delegated to the Federal government under the Constitution. California has adopted these export rules into Title 22 California Code of Regulations for the convenience of the regulated community.

14. Miscellaneous Changes

We are proposing to grant California final authorization for all revisions, if any, to its program due to certain changes to the Federal program which removed certain legally obsolete rules.

The following table shows the Federal and analogous State provisions involved in this tentative decision and the relevant corresponding checklists:

BILLING CODE 6560-50-P

Description of Federal requirement (checklist #)	Federal Register date and page	Analogous State authority
40 Code of Federal Regulations (40 CFR) 60, Appendix A, Air Emission Standards (AirES), checklist 154.	(154) 59 FR 62896, Dec. 6, 1994 [amended by 60 FR 26828, May 19, 1995; 60 FR 50426, Sept. 29, 1995; 60 FR 56952, Nov. 13, 1995; 61 FR 4903, Feb. 9, 1996; 61 FR 28508, June 5, 1996; and 61 FR 59932, Nov. 25, 1996].	(154) Title 22, California Code of Regulations (22 CCR) 66260.11, amended June 11, 1999.
40 CFR 124.31-124.33 Public Participation (Public), checklist 148.	(148) 60 FR 63417, Dec. 11, 1995.	(148) 22 CCR 66260.10, 66271.31-66271.33, amended June 18, 1997.

40 CFR 260.10 Wood and Sludge (Wood), checklist 82; Boilers and Industrial Furnaces (BIF), checklists 85, 111; Toxicity characteristics (TC), checklists 99, 118; Liners and Leak Detection (Liners), checklist 100; Land Disposal Restrictions (LDR), checklist 109; Corrective Action Management Units (CAMU), checklist 121.

(82) 55 FR 50490, Dec. 6, 1990; (85) 56 FR 7134, Feb. 21, 1991; (99) 56 FR 66365, Dec. 23, 1991; (100) 57 FR 3462, Jan. 29, 1992; (109) 57 FR 37194, Aug. 18, 1992; (111) 57 FR 38558, Aug. 25, 1992; (118) 57 FR 54452, Nov. 18, 1992; (121) 58 FR 8658, Feb. 16, 1993.

(99) 22 CCR 66260.10, adopted 1991; (82) 22 CCR 66260.10, amended, 1994; (121) 22 CCR 66260.10, amended 1996; (100) 22 CCR 66260.10, amended July 1, 1996; (85, 111) 22 CCR 66260.10, amended Feb. 11, 1997; (109) 22 CCR 66260.10, amended Aug. 15, 1997; (118) 22 CCR 66260.10, amended Nov. 12, 1998.

40 CFR 260.11 AirES, checklists 79, 154; BIF, checklists 85, 125; TC, checklists 126, 128, 132, 139, 141, 158.

(79) 55 FR 25454, June 21, 1990; (125) 58 FR 38816, July 20, 1993; (126) 58 FR 46040, Aug. 31, 1993; (128) 59 FR 458, Jan. 4, 1994; (132) 59 FR 28484, June 2, 1994; (139) 60 FR 3089, Jan. 13, 1995; (141) 60 FR 17001, Apr. 4, 1995; (158) 62 FR 32452, June 13, 1997.

(79) 22 CCR 66260.11, amended 1993; (85, 125) 22 CCR 66260.11, amended July 1, 1996; (154, 126, 128, 132, 139, 141, 158) 22 CCR 66260.11, amended June 11, 1999.

40 CFR 260.20; BIF, checklist 111.

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(111) California did not adopt this provision.

40 CFR 260.22; TC, checklist 126.

.....

(126) California did not adopt this provision for delisting hazardous waste.

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40 CFR 260.30-260.33; LDR, checklist 137.

(137) 59 FR 47982, Sept. 19, 1994.

(137) California Health and Safety Code (HSC) Division 20, 25143(c), amended 1996. California is not seeking to have these provisions delegated.

40 CFR 261.2; BIF, checklists 85, 94, 96, 111; LDR, checklist 137.

(94) 56 FR 32688, July 17, 1991; (96) 56 FR 42504, Aug. 27, 1991.

(85, 94, 96, 111) HSC Division 20, 25143.2, amended 1988; 22 CCR 66261.2, adopted July 1, 1996; (137) HSC Division 20,

40 CFR 261.3; BIF, checklist 94, 96; TC, checklists 117, 140; LDR, checklists 83, 95, 109; Recovered Oil Exclusion, checklist 135.	(83) 56 FR 3864, Jan. 31, 1991; (95) 56 FR 41164, Aug. 19, 1991; (117) 57 FR 7628, March 3, 1992 and 57 FR 23062, June 1, 1992; (135) 59 FR 38536, July 28, 1994; (140) 60 FR 7824, Feb. 9, 1995 [amended at 60 FR 19165, Apr. 17, 1995; 60 FR 25619, May 12, 1995].	25143.2, amended 1996. (117) HSC Division 20, 25143.2, amended 1994; (135) HSC Division 20, 25144, amended 1995; (135) HSC Division 20, 25143.2, amended 1996; (94, 96) 22 CCR 66261.3; amended Jan. 31, 1997; HSC, Division 20, 25143.2, amended 1988; (83, 95, 109) 22 CCR 66261.3, amended Aug. 15, 1997; (117, 140) 22 CCR 66261.3, amended Nov. 12, 1998.
40 CFR 261.4; TC, checklists 80, 84, 90, 105, 108; Wood, checklists 82, 92; BIF, checklists 85, 105, 110; LDR, checklist 95; Used Oil Filters, checklists 104, 107; Recovered Oil Exclusion, checklist 135.	(80) 55 FR 40834, Oct. 5, 1990; (84) 56 FR 5910, Feb. 13, 1991; (90) 56 FR 66365, Dec. 23, 1991; (92) 56 FR 30192, July 1, 1991; (104) 57 FR 21524, May 20, 1992; (105) 57 FR 27880, June 22, 1992; (107) 57 FR 29220, July 1, 1992; (108) 57 FR 30657, July 10, 1992; (110) 57 FR 37284, Aug. 18, 1992.	(82, 92, 95, 104, 105, 107, 108, 110) California did not adopt these exclusions; (85, 90) HSC Division 20, 25143.1, amended 1991; (80, 84, 105) 22 CCR 66261.24, amended 1994; (135) HSC Division 20, 25144, amended 1995; 25143.2, amended 1996
40 CFR 261.6; AirES, checklists 79, 154; BIF, checklists 85, 94; Recovered Oil Exclusion, checklist 135.	.....	(85) HSC Division 20, 21543.2, amended 1988; (79) 22 CCR 66266.12, adopted 1993; (135) HSC Division 20, 25144, amended 1995; (135) HSC Division 20, 25143.2, amended 1996; (94) 22 CCR 66261.6, amended June 12, 1997; (154) 22 CCR 66261.6, amended June 11, 1999
40 CFR 261.20; LDR, checklist 83.	.....	(83) 22 CCR 66261.20, adopted July 1, 1991
40 CFR 261.22 and 261.24; TC, checklist 126.	.....	(126) 22 CCR 66261.22 and

40 CFR 261.31; LDR, checklist 83; Wood, checklists 81, 82, 89, 120; Removal of Legally obsolete rules, checklist 144.	(81) 55 FR 46354, Nov. 2, 1990, amended at 55 FR 51707, Dec. 17, 1990; (89) 56 FR 21955, May 13, 1991; (120) 57 FR 61492, Dec. 24, 1992 (144) 60 FR 33912, June 29, 1995.	66261.24, amended Nov. 12, 1998 (81, 82, 83, 89, 120) 22 CCR 66261.31, amended Oct. 10, 1994 (144) California did not adopt these rules and does not need to repeal them.
40 CFR 261.32, 261.33; TC, checklists 86, 88, 115, 134, 140; BIF, checklist 110.	(86) 56 FR 7567, Feb. 25, 1991; (88) 56 FR 19951, May 1, 1991; (115) 57 FR 47376, Oct. 15, 1992; (134) 59 FR 31551, June 20, 1994.	(110) 22 CCR 66261.32, amended July 31, 1996; (86, 88, 115, 134, 140) 22 CCR 66261.32, 66261.33, amended Nov. 12, 1998.
40 CFR 261.35; Wood, checklists 82, 92.	.....	(82, 92) 22 CCR 66261.35, adopted 1994.
40 CFR 261, Appendices II, III, VII, VIII, X; Wood, checklists 81, 82; TC, checklists 86, 115, 119, 126, 128, 134, 140; BIF, checklist 110.	(119) 57 FR 55114, Nov. 24, 1992.	(81, 82) 22 CCR, Division 4.5, Chapter 11, Appendices III, VII, VIII, amended 1994; (110) 22 CCR, Division 4.5, Chapter 11, Appendix VII, amended July 31, 1996; (86, 115, 126, 128, 134, 140) 22 CCR, Division 4.5, Chapter II, Appendices II, III, VII, VIII, X, amended Nov. 12, 1998 (119) California did not adopt this regulation.
40 CFR 262.11; LDR, checklist 83.	.....	(83) 22 CCR 66262.11, adopted July 1, 1991.
40 CFR 262.34; Wood, checklists 82, 92; LDR, checklists 83, 109; AirES, checklist 154.	.....	(82, 92) 22 CCR 66262.34, adopted 1994; (83, 109) 22 CCR 66262.34, amended Oct. 28, 1997; (154) 22 CCR 66262.34, amended June 11, 1999
40 CFR 262.53(b) and 262.56(b); Exports, checklist 97.	(97) 56 FR 43704, Sept. 4, 1991.	(97) 22 CCR 66262.53(c) and 66262.56(b), amended 1993
40 CFR 264.1, 265.1; BIF,	(124) 58 FR 29860,	(121) 22 CCR

checklist 111; CAMU,  
checklist 121; LDR,  
checklists 124, 137.

May 24, 1993.

66265.1, amended  
1996; (124) HSC  
Division 20,  
25179.2, amended  
1996; (111, 124) 22  
CCR 66264.1,  
66265.1, amended  
June 12, 1997;  
66270.69, amended  
July 31, 1996;  
(137) California  
did not adopt these  
exemptions.

40 CFR 264.3; CAMU,  
checklist 121.

.....

(121) 22 CCR  
66264.3, amended  
1996

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40 CFR 264.13, 265.13; Delay  
of Closure (Closure),  
checklist 64; AirES,  
checklists 79, 87, 154;  
LDR, checklist 102; TC,  
checklist 118.

(64) 54 FR 33376,  
Aug. 14, 1989; (87)  
56 FR 19290, Apr.  
26, 1991; (102) 57  
FR 8086, Mar. 6,  
1992.

(79, 87) 22 CCR  
66264.13, 66265.13,  
amended 1993; (64,  
102) 22 CCR  
66264.13, amended  
Oct. 22, 1996;  
66265.13, amended,  
July 20, 1996;  
(118) 22 CCR  
66264.13, 66265.13,  
amended Nov. 12,  
1998; (154) 22 CCR  
66264.13, 66265.13,  
amended June 11,  
1999

40 CFR 264.15, 265.15;  
AirES, checklists 79, 154,  
163; Liners, checklist 100.

(163) 62 FR 64636,  
Dec. 8, 1997.

(79) 22 CCR  
66264.15, 66265.15,  
amended 1993; (100)  
22 CCR 66264.15,  
66265.15, amended  
July 19, 1995;  
(154, 163) 22 CCR  
66264.15, 66265.15,  
amended June 11,  
1999

40 CFR 264.19, 265.19;  
Liners, checklist 100.

.....

(100) 22 CCR  
66264.19, 66265.19,  
amended June 30,  
1997

40 CFR 264.73, 264.77,  
265.73, and 265.77; AirES,  
checklists 79, 87, 154,  
163; Liners, checklist 100.

.....

(79, 87) 22 CCR  
66264.73, 66264.77,  
66265.73, and  
66265.77, amended  
1993; (100) 22 CCR  
66264.73, amended  
Jan. 31, 1996;  
66256.73, amended  
June 30, 1997;  
(154, 163) 22 CCR  
66264.73, 66264.77,  
66265.73, and  
66265.77, amended

		June 11, 1999
40 CFR 264.101; CAMU, checklist 121.	.....	(121) 22 CCR 66264.101, amended 1996
40 CFR 264.110-264.111; 265.110-265.111; LDR, checklist 109.	.....	(109) 22 CCR 66264.110-66264.111, 66265.110-66265.111, amended Aug. 15, 1997
40 CFR 264.112, 264.113; 265.112, 265.113; Closure, checklist 64, BIF, checklists 85, 96; LDR, checklist 109.	.....	(64) 22 CCR 66264.112, 66264.113, 66265.112, 66265.113, amended Oct. 22, 1996; (85, 96) 22 CCR 66264.112, 66265.113, amended Dec. 23, 1996; 66265.112, amended Jan. 7, 1997; (109) 22 CCR 66264.112, 66265.112, amended Aug. 15, 1997.
40 CFR 264.140, 264.142, 265.140, 265.142; Closure, checklist 64; LDR, checklist 109.	.....	(64) 22 CCR 66264.142, 66265.142, amended July 20, 1996; 66265.113, amended Oct. 22, 1996; (109) 22 CCR 66264.140, 66264.142, 66265.140, 66265.142, amended Aug. 15, 1997.
40 CFR 264.179, 265.178; AirES, checklist 154.	.....	(154) 22 CCR 66264.179, adopted June 11, 1999; 66265.178, amended June 11, 1999.
40 CFR 264.190, 265.190; Wood, checklist 82; TC, checklist 126.	.....	(82) 22 CCR 66264.190, 66265.190, adopted 1994; (126) 22 CCR 66264.190, 66265.190, amended Nov. 12, 1998.
40 CFR 264.200, 265.202; AirES, checklist 154.	.....	(154) 22 CCR 66264.200, 66265.202, adopted June 11, 1999.
40 CFR 264.221-264.223, 264.226, 264.228, 265.221-365.223, 265.226, 265.228; Liners, checklist 100; LDR, checklist 109.	.....	(100) 22 CCR 66264.221, 66265.221, amended Oct. 21, 1997; 66264.222, 66265.222, 66265.228, amended June 30, 1997; 66264.223, adopted



		July 19, 1995; 66264.228, 66265.223, amended July 19, 1995; (109) 22 CCR 66265.221, amended Aug. 15, 1997.
40 CFR 264.232, 265.231; AirES, checklist 154.	.....	(154) 22 CCR 66264.232, 66265.231, adopted June 11, 1999.
40 CFR 264.251-264.254, 265.254, 265.255, 265.259, 265.260; Liners, checklist 100.	.....	(100) 66264.251, amended Oct. 21, 1997; 66264.252, 66264.253, 66265.254, 66265.255, amended June 30, 1997; 66264.254, amended July 19, 1995, 66265.259, 66265.260, adopted July 19, 1995.
40 CFR 264.301-264.304, 264.310, 265.301-265.304, 265.310; Liners, checklist 100; TC, checklist 108.	.....	(108) 22 CCR 66265.301, amended Aug. 15, 1997; (100) 22 CCR 66264.301, 66265.301, amended Oct. 21, 1997; 66264.302, 66265.302, amended Jun. 30, 1997, 66264.303, 66264.310, amended July 19, 1995; 66264.304, 66265.303-66265.304 , adopted July 19, 1995; 66265.310, amended Aug. 15, 1997.
40 CFR 264.314, 264.316, 265.314, 265.316; TC, checklists 118, 126, 145.	(145) 60 FR 35703, July 11, 1995.	(126) 22 CCR 66264.314, adopted July 1, 1991; (118) 22 CCR 66264.316, 66265.316, amended Nov. 12, 1998; (118, 145) 22 CCR 66264.314, 66265.314, amended Apr. 16, 1999; (126) 22 CCR 66265.314, amended Apr. 16, 1999

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40 CFR 264.340, 265.340; BIF, checklist 85.	.....	(85) 22 CCR 66264.340, 66265.340, amended
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40 CFR 264.552, 264.553; CAMU, checklist 121.	.....	July 1, 1996 (121) 22 CCR 66264.552, 66264.553, amended 1996
40 CFR 264.570-264.575, 265.440-265.445; Wood, checklists 82, 92, 120.	.....	(82, 92, 120) 22 CCR 66264.570-66264.575 , 66265.440- 66265.445, adopted 1994
40 CFR 264.601; AirES, checklist 154.	.....	(154) 22 CCR 66264.601, adopted June 11, 1999
40 CFR 264.1030-264.1036, 40 CFR 265.1030-265.1035; AirES, checklists 79, 87, 154, 163; TC, checklist 158.	.....	(79, 87) 22 CCR 66260.10, amended 1994; 66264.1030, 66264.1032-66264.10 36, 66265.1030, 66265.1032-66265.10 35, adopted 1993; (158) 22 CCR 66264.1034, 66265.1034, amended Nov. 12, 1998; (154, 163) 22 CCR 66260.10, amended Sept. 3, 1999; 66264.1030, 66264.1033, 66264.1034, 66264.1035, 66265.1030, 66265.1033, 66265.1034, 66265.1035, amended June 11, 1999
40 CFR 264.1050-264.1065, 265.1050-265.1064; AirES, checklists 79, 87, 154, 163; TC, checklist 158.	.....	(79, 87) 22 CCR 66260.10, amended 1994; 66264.1050, 66264.1052-66264.10 65, 66265.1050, 66265.1052-66265.10 64, amended 1993; (158) 22 CCR 66264.1063, 66265.1063, amended 1993; (154, 163) 22 CCR 66260.10, amended Sept. 3, 1999; 66264.1050, 66264.1055, 66264.1058, 66264.1060, 66264.1062, 66264.1064, 66265.1050, 66265.1055, 66265.1058. 66265.1060, 66265.1062, 66265.1064, amended

40 CFR 264.1080-264.1090, 264.1091, 265.1080- 265.1090, 265.1091; AirES, checklists 154, 163.	.....	June 11, 1999 (154, 163) 22 CCR 66260.10, amended Sept 3, 1999; 66264.1080, 66264.1082-66264.10 90, 66265.1080, 66265.1082-66265.10 90, adopted June 11, 1999.
40 CFR 264.1100-264.1102, 265.1100-265.1102; LDR, checklist 109.	.....	(109) 22 CCR 66264.1100-66264.11 02, 66265.1100- 66265.1102, amended Aug. 15, 1997.
40 CFR 264, Appendices I, IX; BIF, checklist 131; TC, checklist 158.	(31) 59 FR FR 13891, Mar. 14, 1994.	(131) 22 CCR 66264.801, Appendix I, amended June 12, 1997; (158) 22 CCR, division 4.5, Chapter 14, Appendix IX, amended Nov. 12, 1998.
40 CFR 265.91; TC, checklist 99.	.....	(99) 22 CCR 66265.97- 66265.99, adopted 1991.
40 CFR 265.370; BIF, checklist 94.	.....	(94) 22 CCR 66265.370, amended July 1, 1996.
40 CFR 265, Appendices I, VI; BIF, checklist 131; AirES, checklists 154, 163.	.....	(131) 22 CCR 66265.714, Appendix I, amended June 12, 1997; (154, 163) 22 CCR, Division 4.5, Chapter 15, Appendix I, adopted June 11, 1999.
40 CFR 266.20; Removal of the Conditional Exemption for Certain Slag Residues, Checklist 136.	(136) 59 FR 43496, Aug. 24, 19994 (136) HSC Division 20, 25143.2, amended 1991..	(136) HSC Division 20, 25143.2, amended 1991.
40 CFR 266.23; LDR, checklist 137.	.....	(137) HSC Division 20, 25143.2 amended 1996. California did not adopt the exemption.
40 CFR 266.30-266.35, 266.40 (remove and reserve); BIF, checklists 85, 94.	.....	(85, 94) California did not adopt this regulation and, thus, did not need to remove it.
40 CFR 266.100; TC, checklists 105, 137; Recovered Oil Exclusion, checklist 135; BIF, checklist 105.	.....	(105) 22 CCR 66261.24, amended 1994; (135) HSC Division 20, 25143.2, amended 1996; HSC Division 20, 25144, amended 1995; 22 CCR

		66266.100, adopted July 31, 1996; (137) 22 CCR 66266.100, amended June 12, 1997. (85, 94, 96, 98, 111, 114, 125, 127) 22 CCR 66266.100- 66266.112, amended June 12, 1997.
40 CFR 266.100-266.112; BIF, checklists 85, 94, 96, 98, 111, 114, 125, 127.	(98) 56 FR 43874, Sept. 5, 1991; (114) 57 FR 44999, Sept. 30, 1992; (127) 58 FR 59598, Nov. 9, 1993.	
40 CFR 266.103, 266.104; Removal of Legally Obsolete Rules, checklist 144.	.....	(144) California did not adopt these rules and does not need to repeal them.
40 CFR 266.104, 266.106, 266.107; TC, checklist 158.	.....	(158) 22 CCR 66266.104, 66266.106, 66266.107, amended Nov. 12, 1998.
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40 CFR 266, Appendices I- XIII; BIF, checklists 85, 94, 96, 111, 114, 125, 127; LDR, checklist 137; TC, checklist 158.	.....	(137) Appendix XIII, adopted July 31, 1996; (85, 94, 96, 111, 114, 125, 127) Appendices I-XII, amended June 12, 1997; (158) 22 CCR, Division 4.5, Chapter 16, Appendix IX, amended Nov. 12, 1998.
40 CFR 268.1; LDR, checklist 124, 137.	.....	(124, 137) 22 CCR 66268.1, amended Aug. 15, 1997; (137) California did not adopt one of the exemptions.
40 CFR 268.2; LDR, checklists 83, 109, 124, 137; CAMU, checklist 121.	.....	(121) 22 CCR 66260.10, amended 1996; (83, 109, 124, 137) 22 CCR 66260.10, amended Aug. 15, 1997.
40 CFR 268.3; LDR, checklist 102.	.....	(102) California did not adopt this exemption.
40 CFR 268.5; LDR, checklist 109.	.....	(109) 22 CCR 66268.5, amended Aug. 1997 (California is not seeking to have these extensions delegated.)
40 CFR 268.7; TC, checklist 126; LDR, checklists 83, 109, 124, 137.	.....	(83, 109, 124, 126, 137) 22 CCR 66268.7, amended,

40 CFR 268.9; LDR, checklists 83, 109, 124, 137.	.....	Oct. 28, 1997. (83, 109, 124, 137) 22 CCR 66268.9, amended Aug. 15, 1997.
40 CFR 268.14; LDR, checklist 109.	.....	(109) California did not adopt these exemptions.
40 CFR 268.33; LDR, checklist 83.	.....	(83) 22 CCR 66268.33, amended Aug. 15, 1997.
40 CFR 268.35; LDR, checklists 103, 106, 116, 123.	(103) 57 FR 20766, May 15, 1992; (106) 57 FR 28628, June 26, 1992; (116) 57 FR 47772, Oct. 20, 1992; (123) 58 FR 28506, May 14, 1993.	(103, 106, 116, 123) 22 CCR 66268.33, 66268.35, amended Aug. 15, 1997.
40 CFR 268.36; LDR, checklist 109.	.....	(109) 22 CCR 66268.36, amended Aug. 15, 1997.
40 CFR 268.37; LDR, checklist 124.	.....	(124) HSC Division 20, 25179, amended 1997; 22 CCR 66268.37, amended Aug. 15, 1997.
40 CFR 268.38; LDR, checklist 137.	.....	(137) 22 CCR 66268.38, amended Aug. 15, 1997.
40 CFR 268.40-268.43, 268.45, 268.46; LDR, checklists 83, 95, 102, 109, 124, 137; TC, checklist 126, 134; Removal of the Conditional Exemption for Certain Slag Residues, checklist 136.	.....	(136) HSC Division 20, 25143.2, amended 1991; (134) 22 CCR 66268.42, amended Oct. 16, 1995; (83) 22 CCR 66268.42(c), amended January 31, 1996; (83, 102, 124) 22 CCR 66268.40, amended Aug. 15, 1997; 66268.42, amended Oct. 15, 1997; (95, 137) 22 CCR 66268.40, 66268.41, 66268.42, amended Aug. 15, 1997; (109) 22 CCR 66268.40, 66268.41, 66268.45, amended Aug. 15, 1997; 66268.42, 66268.43, 66268.46, amended Jan. 31, 1996; (137) 22 CCR 66268.43, amended Aug. 15, 1997; 22 CCR 66268.45, 66268.46, amended Jan. 31, 1996; (126) 22 CCR

		66268.40, amended Nov. 12, 1998; 22 CCR 66268.41, amended Aug. 15, 1997.
40 CFR 268.48; LDR, checklist 137.	.....	(137) 22 CCR 66268.48, amended Jan. 31, 1996.
40 CFR 268.50; LDR, checklist 109.	.....	(109) 22 CCR 66268.50, amended Apr. 3, 1996.
40 CFR 268, Appendices I, II, IV, V, VII, VIII, IX LDR, checklists 83, 109, 137; TC, checklist 126.	.....	(83, 109, 137) 22 CCR Division 4.5, Chapter 18, Appendix II, IV, V, VII, VIII, IX, adopted Jan. 31, 1996; (126) 22 CCR Division 4.5, Chapter 18, Appendix I, IX, amended Oct. 28, 1997.
40 CFR 270.2; CAMU, checklist 121; Removal of Legally Obsolete Rules, checklist 144; Public, checklist 148.	.....	(121) 22 CCR 66260.10, amended 1996; (144) California did not adopt these rules and does not need to repeal them. (148) 22 CCR 66260.10, amended June 18, 1997.
40 CFR 270.4; Liners, checklist 100 AirES, checklist 154.	.....	(100) 22 CCR 270.4, adopted July 19, 1995; (154) California did not adopt this regulation.
40 CFR 270.6; TC, checklist 126.	.....	(126) 22 CCR 66260.11, amended June 11, 1999.
40 CFR 270.10; Removal of Legally Obsolete Rules, checklist 144.	.....	(144) California did not adopt these rules and does not need to repeal them.
40 CFR 270.13; LDR, checklist 109.	.....	(109) 22 CCR 66270.13, amended Jan. 31, 1996.
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40 CFR 270.14; AirES, checklist 79; LDR, checklist 109; Public, checklist 148.	.....	(79) 22 CCR 66270.14, amended 1993; (148) 22 CCR 66270.14, amended Dec. 19, 1996; (109) 22 CCR 66270.14, amended Aug. 15, 1997.

40 CFR 270.14-270.17, AirES, ..... checklists 87, 154, 163; Liners, checklist 100.	(87) 22 CCR 66270.14, amended 1993; (100) 22 CCR 66270.17, amended July 19, 1995; (154, 163) 22 CCR 66270.14-66270.17, adopted June 11, 1999.
40 CFR 270.18; Liners, ..... checklist 100.	(100) 22 CCR 66270.18, amended June 30, 1997.
40 CFR 270.19; TC, checklist ..... 126.	(126) 22 CCR 66270.19, amended Nov. 12, 1998.
40 CFR 270.21; Liners, ..... checklist 100.	(100) 22 CCR 66270.21, amended June 30, 1997.
40 CFR 270.22; BIF, ..... checklists 85, 94.	(85, 94) 22 CCR 66270.22, adopted July 1, 1996.
40 CFR 270.24-270.25; AirES, ..... checklists 79, 87.	(79, 87) 22 CCR 66270.24-66270.25, amended Dec. 28, 1993.
40 CFR 270.26; Wood, ..... checklists 82, 92.	(82, 92) 22 CCR 66270.26, adopted 1994.
40 CFR 270.27; AirES, ..... checklists 87, 154, 163.	(87, 154, 163) 22 CCR 66270.27, adopted June 11, 1999.
40 CFR 270.30; Public, ..... checklist 148.	(148) 22 CCR 66270.30, amended Dec. 19, 1996.
40 CFR 270.42, 270.43; ..... Appendix I, Closure, checklist 64; BIF, checklists 85, 94; LDR, checklists 83, 109, 124; Liners, checklist 100, CAMU, checklist 121.	(85, 94) 22 CCR 66270.42, amended July 31, 1996; (64, 83, 85, 94, 109, 121, 124) 22 CCR Division 4.5, Chapter 20, Appendix I, amended July 31, 1996; (100) 22 CCR Division 4.5, Chapter 20, Appendix I, amended June 30, 1997.
40 CFR 270.61, 270.62, ..... 270.66; BIF, checklists 85, 94; TC, checklist 126; Public, checklist 148.	(85, 94) 22 CCR 66270.66, amended June 12, 1997; (148) 22 CCR 66270.61, adopted May 24, 1991; 22 CCR 66260.10, 66270.62, 66270.66 amended June 18, 1997; (126) 22 CCR 66270.62, 66270.66, amended Nov. 12,

40 CFR 270.72-270.73; BIF, checklists 85, 94; LDR, checklist 109.	1998. (85, 94) 22 CCR 66270.72-66270.73, amended July 31, 1996; (109) 22 CCR 66270.72, amended July 31, 1996.
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BILLING CODE 6560-50-M

H. Where Are the Revised State Rules Different From the Federal Rules?

State requirements that go beyond the scope of the Federal program are not part of the authorized program and EPA can not enforce them. Although you must comply with these requirements in accordance with California law, they are not RCRA requirements. We consider that the following State requirements, which pertain to the revisions involved in this tentative decision, go beyond the scope of the Federal program. The following analysis differs in some ways from the areas which California identified as being broader in scope than the Federal program in its application.

1. The definition of ``remediation waste'' at 22 C.C.R. Sec. 66260.10 is broader in scope than the Federal definition at 40 CFR 260.10 only to the extent California's definition includes hazardous substances which are neither ``hazardous wastes'' nor ``solid wastes.''

2. 22 C.C.R. Sec. 66264.552(e)(4)(A)(2) is broader in scope than 40 CFR 264.552(e)(4)(i)(B) only to the extent the California provision controls the escape of ``hazardous substances'' which are not ``hazardous waste,'' ``hazardous constituents,'' ``leachate,'' ``contaminated runoff'' or ``hazardous waste decomposition products.''

3. California's program is broader in scope than the Federal program to the extent it regulates spent wood preserving solutions that have been used and are reclaimed and reused for their original intended purpose and wastewaters from the wood preserving process that have been reclaimed and are reused to treat wood. These materials are excluded from the Federal definition of solid waste by virtue of 40 CFR 261.4(a)(9)(i) and (ii), respectively.

4. HSC Sec. 25144(c) is broader in scope than 40 CFR 261.4(a)(12) since the California provision exempts oil recovery process units and associated storage units from regulation, rather than exempting recovered oil from the definition of solid waste, which is what the Federal provision does. Thus, the State program is broader in scope than the Federal program to the extent California regulates recovered oil not contained in such recovery process units or associated storage units.

5. HSC Sec. 25143.2(c)(1) was broader in scope than was former section 40 CFR 261.6(a)(3)(vi) (renumbered as 261.6(a)(3)(v) in 1995 (60 FR 25492 \1\)), which exempted from regulation petroleum coke produced from petroleum refinery hazardous waste containing oil produced by the same person who generated the waste unless the resulting coke product was characteristically hazardous. HSC Sec. 25143.2(c)(1), which was part of the authorized program, was not amended to conform to the changes made to 40 CFR 261.6(a)(3)(vi) in 1994. At that time, the Federal exemption was expanded to include petroleum coke produced by the same person who generated the petroleum hazardous waste containing oil, rather than being limited to petroleum coke produced at the same facility at which such wastes were generated. The State's exemption retains the ``at the same facility''



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language and, to this extent, is broader than the Federal requirement.\2\

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\1\ 40 CFR 261.6(a)(3)(v) was superceded by 40 CFR 261.4(a)(12) in 1998 (63 FR 42110).

\2\ The 1998 revision to 40 CFR 261.4(a)(12) changed the Federal requirement again to limit the exemption to materials which are inserted into the same petroleum refinery where they are generated or sent directly to another petroleum refinery. Thus the State's exemption remains narrower than the Federal exemption in this respect.

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6. California does not have the Federal exclusion found at 40 CFR 261.4(b)(13), which excludes from the definition of hazardous waste non-terne plated used oil filters that are not mixed with hazardous wastes if those filters are gravity hot drained in accordance with specified procedures. To the extent California regulates such oil filters, its program is broader in scope than the Federal program.

7. California has not adopted the Federal exclusion found at 40 CFR 261.4(a)(10). This provision excludes from the definition of solid waste K060, K070, K087, K141, K142, K143, K145, K147, K148, and those coke by-product residues that are hazardous only because they exhibit the toxicity characteristic when, subsequent to generation, these wastes are recycled by being returned to coke ovens, to the tar recovery process as a feedstock to produce coal tar or mixed with coal tar. The Federal exclusion is conditioned on there being no land disposal of the waste from the point of generation to the point of recycling. Thus, the absence of this exemption makes the California program broader than the Federal program in this respect.

8. California has not adopted the Federal provision at 40 CFR 266.100(b)(3), which exempts from regulation the burning of wastes produced by conditionally exempt small quantity generators (see also 40 CFR 261.5). Thus, California's program is broader in scope than the Federal program in this respect.

9. California has not adopted the Federal provision at 40 CFR 266.100(b)(4), which excludes from regulation coke ovens if the only hazardous waste burned is K087, decanter tank tar sludge from coking operations. The Federal provision was a necessary corollary to EPA's removal of the coke and coal tar exemption (formerly 40 CFR 261.6(a)(3)(vii)) due to the reclassification of coke and coal tar as products under 40 CFR 261.4(a)(10) in 1991. California had not adopted the exemption as part of the base program, nor did it adopt the 1991 exemption at 40 CFR 261.4(a)(10). Thus, the California program is broader in scope than the Federal program to the extent California regulates coke ovens that solely burn K087.

10. The California provision at 22 C.C.R. Sec. 66266.100(b)(3) excludes from regulation in boilers and industrial furnaces ("BIFs") those materials which are exempted from regulation at 22 C.C.R. Sec. 66261.4. This provision tracks the Federal provision at 40 CFR 266.100(b)(3), which excludes from regulation in BIFs those materials which are exempted from regulation at 40 CFR 261.4. The Federal provision at 40 CFR 261.4 includes more exemptions than the State provision at 22 CCR Sec. 66266.4 and, therefore, California's BIF program is broader in scope than the Federal program in this respect.

11. 40 CFR 261.4(a)(11) excludes from the definition of solid waste, non-wastewater splash condenser dross residue from the treatment of K061 in high temperature metals recovery units provided it is

shipped in drums (if shipped) and is not land disposed before recovery. California has not adopted this exclusion and its program is thus broader in scope than the Federal program in this respect.

12. California's program is broader in scope than the Federal program with respect to the regulation of secondary materials that are recycled back into secondary production processes from which they were generated. 40 CFR 261.2(e)(1)(iii) exempts such materials, so long as the materials are managed such that there is no placement on the land. HSC 25143.2(b)(3), as restricted by HSC sections 25143.2(e) and 25143.9, which is the State's analogue to 40 CFR 261.2(e)(1)(iii), excludes only recyclable materials that are returned to a primary process.

#### I. Who Handles Permits After the Authorization Takes Effect?

California will issue permits for all the provisions for which it is authorized and will administer the permits it issues. All permits issued by EPA prior to California being authorized for these revisions will continue in force until the effective date of the State's issuance or denial of a State RCRA permit, or the permit otherwise expires or is revoked. California will administer any RCRA hazardous waste permits or portions of permits which EPA issued prior to the effective date of this authorization until such time as California has issued a corresponding State permit. EPA will not issue any more new permits or new portions of permits for provisions for which California is authorized after the effective date of this authorization. EPA will retain responsibility to issue permits needed for HSWA requirements for which California is not yet authorized.

#### J. How Would Authorizing California for These Revisions Affect Indian Country (18 U.S.C. 115) in California?

California is not authorized to carry out its hazardous waste program in Indian country within the State. A map of Indian Country in California can be found on the world wide web at [http://www.epa.gov/region09/cross\\_pr/indian/maps.html](http://www.epa.gov/region09/cross_pr/indian/maps.html). A list of Indian Tribes in California can be found on the web at <http://www.doi.gov/bureau-indian-affairs>; it is complete except for two newly listed tribes, Graton and Lower Lake Rancherias. Therefore, this proposed action would have no effect on the Indian country so described, including Graton and Lower Lake Rancherias. EPA will continue to implement and administer the RCRA program in Indian country within the State.

#### K. Administrative Requirements

The Office of Management and Budget has exempted RCRA authorizations from the requirements of Executive Order 12866 (58 FR 51735, October 4, 1993) and, therefore, a decision to authorize California for these revisions is not subject to review by OMB. This authorization will effectively suspend the applicability of certain Federal regulations in favor of California's program, thereby eliminating duplicative requirements for handlers of hazardous waste in the State. Authorization will not impose any new burdens on small entities. Accordingly, I certify that authorization for these revisions will not have a significant economic impact on a substantial number of small entities under the Regulatory Flexibility Act (5 U.S.C. 601 et seq.). Because implementing this proposal would authorize pre-existing requirements under State law and would not impose any additional enforceable duty beyond that required by State law, it will not contain any unfunded mandate or significantly or uniquely affect small governments, as described in the Unfunded Mandates Reform Act of 1995

(Pub. L. 104-4). For the same reason, this proposed rule does not have tribal implications within the meaning of Executive Order 13175 (65 FR 67249, November 6, 2000). It does not have substantial direct effects on Tribal governments, on the relationship between the Federal government and the Indian tribes, or on the distribution of power and responsibility between the Federal government and Indian tribes, as specified in Executive Order 13175. Authorization will not have substantial direct effects on the states, on the relationship between the national

[[Page 33046]]

government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132 (64 FR 43255, August 10, 1999), because it merely authorizes State requirements as part of the State RCRA hazardous waste program without altering the relationship or the distribution of power and responsibilities established by RCRA. A decision to authorize California for these revisions also is not subject to Executive Order 13045 (62 FR 19885, April 23, 1997), because it is not economically significant and it does not make decisions based on environmental health or safety risks. The proposed rule does not include environmental justice related issues that require consideration under Executive Order 12898 (59 FR 7629, February 16, 1994).

Under RCRA 3006(b), EPA grants a state's application for authorization as long as the state meets the criteria required by RCRA. It would thus be inconsistent with applicable law for EPA, when it reviews a state authorization application, to require the use of any particular voluntary consensus standard in place of another standard that otherwise satisfies the requirements of RCRA. Thus, the requirements of section 12(d) of the National Technology Transfer and Advancement Act of 1995 (15 U.S.C. 272 note) do not apply. As required by section 3 of Executive Order 12988 (61 FR 4729, February 7, 1996), in issuing this proposed rule, EPA has taken the necessary steps to eliminate drafting errors and ambiguity, minimize potential litigation, and provide a clear legal standard for affected conduct. EPA has complied with Executive Order 12630 (53 FR 8859, March 15, 1988) by examining the takings implications of a decision to authorize California for these revisions in accordance with the Attorney General's Supplemental Guidelines for the Evaluation of Risk and Avoidance of Unanticipated Takings issued under the Executive Order. A decision to authorize California's revisions will not impose an information collection burden under the provisions of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.).

List of Subjects in 40 CFR Part 271

Environmental protection, Administrative practice and procedure, Confidential business information, Hazardous waste, Hazardous waste transportation, Indian lands, Intergovernmental relations, Penalties, Reporting and record keeping requirements.

Authority: This proposed action is issued under the authority of sections 2002(a), 3006 and 7004(b) of the Solid Waste Disposal Act as amended 42 U.S.C. 6912(a), 6926, 6974(b).

Dated: June 12, 2001.

Laura Yoshii,  
Acting Regional Administrator, Region 9.

[FR Doc. 01-15481 Filed 6-19-01; 8:45 am]

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OSWER DIRECTIVE # 9476.00-13

FEB 8 1988

OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE

MEMORANDUM

SUBJECT: Regulatory Interpretation of the Closure  
Performance Standard

FROM: Marcia Williams, Director  
Office of Solid Waste

TO: William Miner, Chief  
Solid Waste Branch, Region V

In your memorandum of December 31, 1987 you requested our views on whether the closure performance standard (264.111 and 265.111) could be used to require source control at two particular surface impoundments which the owner/operator wishes to close as landfills. Our response to your question first addresses the issue in a general way and then turns to your specific question concerning the two surface impoundments.

The general performance standards and the technical standards complement each other, and both must be complied with (See 51 FR 16424). Where the unit-specific technical standards provide detailed instructions, those procedures should be followed. In exceptional cases where unit-specific standards may not be enough to minimize or eliminate post-closure escape of hazardous constituents, you should look to the closure performance standard for authority to require additional control measures.

In addition, the preamble to the March 19, 1985 Proposed Rule for Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (a Final version of the Rule was published on May 2, 1986) states, in 51 FR 11070, that

"the amendment explicitly requires owners or operators of TSDFs to comply with both the general performance standard and the applicable process-specific standards. Owners or operators must close their facilities in a manner that complies with applicable process-specific requirements where specified; the general performance

standards apply to activities that are not otherwise addressed by the process-specific standards but are necessary to ensure that the facility is closed in a manner that will ensure protection of human health and the environment."

The final rule for Closure, Post-Closure and Financial Responsibility Requirements (May 2, 1986) further states, in 51 FR 16424, that TSDFs must "comply with both the general performance standard and the applicable process-specific standards."

These authorities support your position that the closure performance standard can be used as a basis for requiring source control when necessary to achieve this standard. 40 CFR Subpart G, Sections 264.112 and 265.112 requires a description of how each unit and facility will be closed in accordance with Sections 264.111/265.111 (see Sections 264.112/265.112(b) (1) and (2)). Section 265.112(b) in particular, requires that the closure plan include "a detailed description of other activities necessary during the partial and final closure period to ensure that all partial closures and final closure satisfy the closure performance standards, including, but not limited to, ground-water monitoring, leachate collection, and run-on and run-off control."

Your memorandum indicates that hazardous constituents may migrate into ground water because the water table may come into contact with the bottom of the unit. The closure requirements at 264.228/265.228 were designed to minimize infiltration through the cap. Therefore the problem identified in this case is not addressed by the design-specific requirements, and the 264.111/265.111 performance standard can be invoked to require additional actions.

It is also important that the closure process is consistent with any corrective action process that may be required in the future. In the case of these two surface impoundments, your memorandum indicates that releases are currently occurring and that these releases would not be minimized if closure were performed with significant amounts of waste in place. Corrective action to address such releases could necessitate removal of the waste. If this occurred after capping, the action would be seriously complicated and substantial resources would have been wasted on the cap.

An alternative approach to using the closure performance standard as a tool for obtaining environmentally sound closure and to address releases, would be to use a post-closure permit and/or a 3008(h) order issued in conjunction with closure plan approval.

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In conclusion, it is the Region and/or the state's choice (depending on which level of government is authorized to implement RCRA) as to which tool is used. Clearly the regulations allow the use of the general performance standards, post-closure permits or 3008(h) orders to ensure that facilities close in a way that is protective of human health and the environment.

cc: Robert Swale, Region V  
Lee Tyner, OGC  
Chris Rhyne, OSW  
Jim Bachmaier, OSW  
Lauris Davies, OSW  
Regional Division Directors

Attachment

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION V

DATE: 31 DEC 1987

SUBJECT: Regulatory interpretation of the Closure Performance Standard  
For Surface Impoundments At GMC Harrison Radiator, Dayton, Ohio

FROM: William Miner, Chief  
Solid Waste Branch

TO: Marcia Williams, Director  
Office of Solid Waste

The Closure Performance Standard under 40 CFR Part 265.111(b) calls for the Owner/Operator to close the facility in a manner that "Controls, minimizes or eliminates.....post closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters..." GMC Harrison Radiator has proposed the closure as a landfill option for their regulated surface impoundments; which, we contend, will not meet the closure performance standards as defined above. We believe that proposed method of closure will not provide adequate protection against the release of hazardous constituents to the groundwater underlying the facility; and, as such, does not provide adequate protection for human health and the environment, as called for under the Closure Performance Standard.

The facility has two surface impoundments which receive a variety of hazardous wastes beginning with the "South Lagoon" constructed in 1966, and the "North Lagoon" which was constructed in 1972. Both lagoons accepted wastewaters containing halogenated solvents, which in the case of the North Lagoon, has compromised groundwater quality to a significant degree.

Recent groundwater quality assessment data for the North Lagoon has revealed concentrations of halogenated solvents which exceed the Maximum Concentration Limits for drinking water by an average of twenty times. It is also believed that the South Lagoon is affecting groundwater quality as well, but it is unknown at this time the concentrations of any specific hazardous constituents.

The Exposure Information Report (EIR), completed for the regulated units at the GMC facility, concluded that the proposed method of closure may not minimize the production of leachate which will occur as a result of groundwater infiltration into the stabilized wastes. In particular, page 47 of the EIR states, "It is assumed that water levels will rise when pumping of (the) county wells is discontinued, with gradients and water levels returning to near historic (prepumping) conditions. Water levels may rise to elevated above those of the bottoms of the lagoons..."



As such, it is possible that some of the recompacted sludges contained within the closed facilities may be below the water table. This could result in leaching of the wastes...."

We do not believe that GMC can adequately demonstrate that they can minimize or eliminate the post-closure escape of hazardous constituents to the groundwater (as required by the Closure Performance Standard) simply due to the expectation that the stabilized wastes will lie within the aquifer after closure has been completed. Also, the presence of groundwater contamination from the impoundments leads us to believe that simply capping the impoundment will not alleviate the problem. We propose that GMC has only two options for the regulated impoundments: 1) GMC must remove the wastes presently in the impoundments and dispose of them off-site or; 2) Remove the wastes from the present units and construct a doubly-lined landfill unit in its place, and construct the unit at least one meter above the highest expected groundwater elevation. We believe that these methods of closure will adequately meet the closure performance standard, since they will demonstrate that the post-closure escape of hazardous constituents to the groundwater has been thoroughly minimized.

We request that a determination be made by your office concerning our argument that the intent of the closure performance standard precludes closure as a landfill. In any event, we will be pursuing corrective action either in a postclosure permit or with a 3008(h) order. However, if we can require excavation through the closure process, appropriate action can be started much more quickly. Approval of this closure plan is a 3rd Quarter FY '88 commitment by the Region, and we have tentatively scheduled a meeting with GMC to discuss these closure concerns for mid-January 1988. Therefore, we request that you respond to this memo by January 10, 1988, so that we can be prepared when we meet with the facility.

Specific questions concerning the facility can be answered by Robert Swale, the closure plan reviewer for this facility. Mr. Swale can be reached at FTS 886-6591.

cc: Anthony Sasson, OEPA  
Randy Meyer, OEPA  
Richard Robertson, OEPA-SWDO

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

EPA 540-F-98-061  
OSWER 9200.4-29  
PB 99-963211  
December 1, 1998

**MEMORANDUM**

**SUBJECT:** Proposed TSCA §403 Soil Lead Hazard and OSWER's Lead-in-Soils Policy

**FROM:** Lynn R. Goldman, M.D., Assistant Administrator  
Office of Prevention, Pesticides and Toxic Substances

Timothy Fields, Jr., Acting Assistant Administrator  
Office of Solid Waste and Emergency Response

**TO:** Regional Administrators, Regions I-X

The purpose of this memorandum is to address some concerns that have been brought to our attention following the June 3, 1998, publication of the proposed Toxic Substances Control Act (TSCA) §403 Rule. In particular, questions have arisen about the relationship between the proposed TSCA §403 rule and the Office of Solid Waste and Emergency Response's (OSWER's) Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Facilities (OSWER Directive # 9200.4-27P, August 27, 1998). This memo draws upon existing information in the TSCA §403 proposal, the 1994 TSCA §403 guidance, and the OSWER soil lead directive to address this issue.

**Proposed TSCA §403 Rule**

The June 3, 1998, proposal would identify lead-based paint hazards, which include hazardous lead paint as well as residential dusts and soils that have levels of lead considered to be hazards (regardless of whether they were contaminated with paint or other lead sources). In addition, TSCA §403 requires the Agency to identify lead-containing residential dusts and soils, some of which present public health concerns but may be lower than the levels identified by the hazard standards. These dusts and soils are referred in the statute as lead-contaminated dust and lead-contaminated soil. In the preamble to the proposal and in accompanying draft guidance, EPA identified 400 parts per million (ppm) of lead in soil as a level of public health concern. When environmental levels exceed the contamination level, EPA's baseline expectation is that children may be at risk of having elevated blood lead levels. The occurrence and the magnitude of this risk will depend on the specific circumstances.

EPA has proposed a 2,000 ppm hazard standard for lead in soil at which children's exposures will be associated with a greater certainty of harm. When soil lead levels exceed the hazard level, the Agency has a strong expectation, even in the absence of further data on local circumstances, that children will be at appreciable risk of elevated blood lead levels. The hazard standard was intended as a "worst first" level that will aid in setting priorities to address the greatest lead risks promptly. The proposed §403 regulations and the accompanying guidance are to be used by Federal, State, and Tribal lead paint programs, as well as by the industry performing inspections and risk assessments.

Already several weeks into the public comment period, EPA has received some comments that indicate a lower standard may be a more appropriate standard for protecting children. At the same time, others that have provided comments indicate that the proposed level of 2,000 ppm may tend to refocus efforts away from addressing other lead hazards in housing. EPA has extended the public comment period and is holding workshops with Federal agencies and affected groups to bring forward as much information as possible to inform the final decision.

### **OSWER's Soil Lead Directive**

The OSWER soil lead directive that provides guidance for the cleanup of lead-contaminated sites under the CERCLA and RCRA laws is unaffected by this proposal. CERCLA and RCRA soil lead cleanups should follow the approach in the 1998 directive. In contrast with minimum national standards that are designed to be used at millions of widely varying sites across the nation under TSCA §403, the studies that take place at CERCLA or RCRA sites allow levels to be developed that consider site-specific information. The TSCA §403 proposed 2,000 ppm hazard level should not be treated as an Applicable or Relevant and Appropriate Requirement (ARAR), "to be considered" or TBC, or media cleanup standard (MCS). As recognized in the TSCA §403 rule, lead contamination at levels below 2,000 ppm may pose a serious health risk based upon a site-specific evaluation and may warrant timely response actions. Thus, the 2,000 ppm proposed hazard standard under TSCA §403 should not be used to modify approaches to addressing Brownfields, RCRA sites, National Priorities List (NPL) sites, State Superfund sites, Federal CERCLA removal actions, and CERCLA non-NPL facilities.

### **Program Similarities**

At lead-contaminated residential sites, both OPPTS and OSWER seek to protect the health of the most susceptible population (children under seven years of age) and to promote a program that assesses and addresses risk. The approaches taken by the two programs share many important aspects, but also differ in some respects because of the purposes of each program.

The OSWER soil lead directive and the TSCA §403 proposed rule both rely upon the Integrated Exposure Uptake Biokinetic Model (IEUBK) for lead in children. The OSWER soil lead guidance recommends that the IEUBK Model be applied to utilize site-specific information that can be very important in evaluating the risks at hazardous waste sites with residential exposure scenarios. Similarly, the TSCA

§403 proposal employs analyses that have relied upon the IEUBK Model to assess risks to children.

In the absence of site-specific information, EPA believes that soil lead levels above 400 ppm may pose a health risk to children through elevated blood lead levels. The 400 ppm screening level identified in the OSWER soil lead guidance is consistent with the "level of concern" identified in the preamble to the proposed TSCA §403 rule. Site-specific information would provide a basis to identify a different soil lead level that would be protective of health. Although lead contamination at levels below 2,000 ppm may not meet the TSCA §403 proposed hazard level, it may pose serious health risks and may warrant timely response actions including abatement.

### **Conclusion**

In closing, we want to emphasize that the proposed 2,000 ppm hazard level for lead in soils is not a final level and may change in response to public comments. The proposed level should not be used to modify or select responses at RCRA, CERCLA, Brownfields, or State Superfund sites.

We hope that the clarifications provided in this memorandum are helpful. If you have any questions, please feel free to call Lynn Goldman at 202-260-2902 or Tim Fields at 202-260-4610. Regional program managers should contact Larry Reed, Deputy Director of the Office of Emergency and Remedial Response (OERR) in OSWER at 703-603-8960 or John Melone, Director of the National Program Chemical Division (NPCD) in OPPTS at 202-260-1866.

cc: RCRA/CERCLA National Program Managers, Regions I-X  
Steve Luftig  
Larry Reed  
Jim Woolford  
Bill Sanders  
John Melone

FAKBACK 13079  
9/1987(24)

## LEACHING TESTS FOR EVALUATING SOILS CONTAMINATED WITH LEAD

NOV 5 1987

### MEMORANDUM

SUBJECT: Appropriate leaching test to use in evaluating soils contaminated with lead.

DATE: October 30, 1987

FROM: David Friedman, Chief  
Methods Section (WH-562B)

THRU: Alec McBride, Chief  
Technical Assessment Branch (WH-562B)

TO: Thomas Spittler, Chief  
Laboratory Branch, Region I

As you requested, I am writing to review the regulatory status of the various leaching test that have been developed for use in the hazardous waste program with respect to the problem of assessing the regulatory status of contaminated soils.

When evaluating a soil, or other waste, to determine whether it is a hazardous waste by reason of the toxicity characteristic one should use Method 1310, the Extraction Procedure. While, sometime in the future, we expect to replace Method 1310 with the new Toxicity Characteristic leaching Procedure (TCLP), the TCLP has not yet been promulgated for such use.

As indicated at the recent meeting in Annapolis of the Regional laboratory chiefs, OSW has recently developed Method

1312 for use in evaluating the leaching potential of in-place soils and debris. This test, which is a modification of the TCLP, employs regional specific simulated acid precipitation as the extraction medium. As you recently noted in your work on neutral soils contaminated with lead, the high acetate concentration of the TCLP relative to the Ep means that the TCLP

-2-

is significantly more aggressive than the EP for such materials. For this, and other reasons, OSW feels that use of the TCLP for determining the ground water contamination of soils and debris that are to remain in place is a misapplication of the procedure. In upcoming guidance manuals on both making clean

closure determinations, and on facility investigations, the Agency will approve Method 1312 for use as the leaching estimation tool for those situations. For your convenience, I have enclosed a draft copy of Method 1312.

I hope I have clarified the use of the different methods for you. I want to thank you for calling my attention to the problem you faced when the TCLP was applied to the contaminated soils in your area. I am sorry that I did not get a chance to see you in Annapolis last week.

cc: All Regional Laboratory Chiefs  
All Regional ESD Directors  
All Regional Solid Waste Branch Chiefs

Enclosure

United States  
Environmental Protection Agency

Solid Waste and  
Emergency Response  
(5305W)

EPA530-F-98-026  
October 1998  
[www.epa.gov/osw](http://www.epa.gov/osw)

# Management of Remediation Waste Under RCRA

*printed on paper that contains at least 20 percent postconsumer fiber*

October 14, 1998

**MEMORANDUM**

**SUBJECT:** Management of Remediation Waste Under RCRA

**TO:** RCRA/CERCLA Senior Policy Managers  
Regional Counsels

**FROM:** Timothy Fields, Jr., Acting Assistant Administrator for  
Solid Waste and Emergency Response */signed/*

Steven A. Herman, Assistant Administrator for  
Enforcement and Compliance Assurance */signed/*

Rapid clean up of RCRA corrective action facilities and Superfund sites is one of the Agency's highest priorities. In this context, we often receive questions about management of remediation waste under the Resource Conservation and Recovery Act (RCRA). To assist you in successfully implementing RCRA requirements for remediation waste, this memorandum consolidates existing guidance on the RCRA regulations and policies that most often affect remediation waste management. We encourage you to work with the regulations, policies and approaches outlined in this memorandum to achieve our cleanup goals as quickly and efficiently as possible.

Note that not all remediation wastes are subject to RCRA Subtitle C hazardous waste requirements. As with any other solid waste, remediation wastes are subject to RCRA Subtitle C only if they are listed or identified hazardous waste. Environmental media are subject to RCRA Subtitle C only if they contain listed hazardous waste, or exhibit a characteristic of hazardous waste. These distinctions are discussed more completely below.

The information in this memo is divided into three categories: information on regulations and policies that apply to all remediation waste; information on regulations and policies that apply only to contaminated media; and, information on regulations and policies that apply only to contaminated debris. Most of the references cited in this memo are available over the Internet. The Federal Register notices published after 1994 are available at [www.access.gpo.gov/nara](http://www.access.gpo.gov/nara); the guidance memos and other EPA documents are available at [www.epa.gov/correctiveaction](http://www.epa.gov/correctiveaction). Federal Register notices and other documents are also available through the RCRA/CERCLA hotline: in Washington D.C., call (703) 412-



9810; outside Washington D.C., call (800) 424-9346; and hearing impaired call (800) 553-7672. The hotline's hours are Monday - Friday, excluding Federal holidays, 8:00 - 5:00, eastern standard time. Many EPA guidance memos and other documents may also be obtained through the RCRA/CERCLA hotline fax-back system. To obtain a list of documents available over the fax-back system, and fax-back system code numbers, call the RCRA/CERCLA hotline at the numbers listed above.

I hope this information will assist you as you continue to make protective, inclusive, and efficient cleanup decisions. If you have additional questions or require more information, please contact Robert Hall or Greg Madden, of our staffs, on (703) 308-8484 or (202) 564-4229 respectively.

## **Regulations and Policies that Apply to All Remediation Wastes**

**Area of Contamination Policy.** In what is typically referred to as the area of contamination (AOC) policy, EPA interprets RCRA to allow certain discrete areas of generally dispersed contamination to be considered RCRA units (usually landfills). Because an AOC is equated to a RCRA land-based unit, consolidation and *in situ* treatment of hazardous waste within the AOC do not create a new point of hazardous waste generation for purposes of RCRA. This interpretation allows wastes to be consolidated or treated *in situ* within an AOC without triggering land disposal restrictions or minimum technology requirements. The AOC interpretation may be applied to any hazardous remediation waste (including non-media wastes) that is in or on the land. Note that the AOC policy only covers consolidation and other *in situ* waste management techniques carried out within an AOC. For *ex situ* waste management or transfer of wastes from one area of contamination to another, see discussion of corrective action management units, below.

The AOC policy was first articulated in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). See 53 FR 51444 for detailed discussion in proposed NCP preamble; 55 FR 8758-8760, March 8, 1990 for final NCP preamble discussion. See also, most recent EPA guidance, March 13, 1996 EPA memo, "Use of the Area of Contamination Concept During RCRA Cleanups."

**Corrective Action Management Units (CAMUs).** The corrective action management unit rule created a new type of RCRA unit -- a Corrective Action Management Unit or CAMU -- specifically intended for treatment, storage and disposal of hazardous remediation waste. Under the CAMU rule, EPA and authorized states may develop and impose site-specific design, operating, closure and post-closure requirements for CAMUs in lieu of MTRs for land-based units. Although there is a strong preference for use of CAMUs to facilitate treatment, remediation waste placed in approved CAMUs does not have to meet LDR treatment standards.

The main differences between CAMUs and the AOC policy (discussed above) are that, when a CAMU is used, waste may be treated *ex situ* and then placed in a CAMU, CAMUs may be located in uncontaminated areas at a facility, and wastes may be consolidated into CAMUs from areas that are not contiguously contaminated. None of these activities are allowed under the AOC policy, which, as discussed above, covers only consolidation and *in situ* management techniques carried out within an AOC.

CAMUs must be approved by EPA or an authorized state and designated in a permit or corrective action order. In certain circumstances, EPA and states (including states that are not authorized for the CAMU regulations) may use other mechanisms to approve CAMUs. See, 58 FR 8677, February 16, 1993; appropriate use of RCRA Section 7003 orders and comparable state orders is discussed below and in an EPA guidance memo from J. Winston Porter to EPA Regional Administrators, "RCRA Permit Requirements for State Superfund Actions," November 16, 1987, OSWER Directive 9522.00-2. In addition, as appropriate, CAMUs may be approved by EPA as an applicable or relevant and appropriate requirement during a CERCLA cleanup using a record of decision or by an authorized state during a state cleanup using a CERCLA-like authority and a similar state document. See, e.g., 58 FR 8679, February 16, 1993. An opportunity for the public to review and comment on tentative CAMU approvals is required by the regulations when CAMUs are approved using permitting procedures and as a matter of EPA policy when CAMUs are approved using orders. EPA recommends that, whenever possible, remediation project managers combine this public participation with other public involvement activities that are typically part of remediation. For example, public notice of tentative approval of a CAMU could be combined with public notice of a proposed plan under CERCLA.

The CAMU rule is currently subject to litigation; however, the suit has been stayed pending promulgation of the final HWIR-Media regulations. Although EPA proposed to withdraw CAMUs as part of the HWIR-Media proposal, the Agency now intends to retain the CAMU rule. The Agency encourages approval of CAMUs when they are appropriate given the site-specific conditions.

The CAMU regulations are at 40 CFR 264.552, promulgated February 16, 1993 (58 FR 8658). The differences between CAMUs and AOCs are discussed in more detail in the March 13, 1996 EPA guidance memo, "Use of the Area of Contamination Concept During RCRA Cleanups."

**Corrective Action Temporary Units (TUs).** Temporary units, like corrective action management units, are RCRA units established specifically for management of hazardous remediation waste. The regulations for temporary units (TUs) were promulgated at the same time as the regulations for corrective action management units. The CAMU regulations established land-based units for treatment, storage and disposal of remediation waste; the TU regulations established non-land based units for treatment and storage of hazardous remediation waste. Under the TU regulations, EPA and authorized states may modify existing MTR design, operating and closure standards for temporary tank and container units used to treat and store hazardous remediation waste. Temporary units may operate for one year, with an opportunity for a one year extension.

Like CAMUs, temporary units must be approved by EPA or an authorized state and designated in a permit or corrective action order. In certain circumstances, EPA and states (including states that are not authorized for the TU regulations) may use other mechanisms to approve TUs. See, 58 FR 8677, February 16, 1993; appropriate use of RCRA Section 7003 orders and comparable state orders is discussed below and in an EPA guidance memo from J. Winston Porter to EPA Regional Administrators, "RCRA Permit Requirements for State Superfund Actions," November 16, 1987, OSWER Directive 9522.00-2. In addition, as appropriate, TUs may be approved by EPA as an applicable or relevant and appropriate requirement during a CERCLA cleanup using a record of decision or by an authorized state during a state cleanup using a CERCLA-like authority and a similar

state document. Placement of waste in tanks or containers, including temporary units, is not considered land disposal. Therefore, waste does not have to be treated to meet LDR treatment standards prior to being placed in a TU. Of course, LDRs must be met if hazardous remediation wastes are eventually land disposed, for example, after they are removed from the TU; however, if treatment in a TU results in constituent concentrations that comply with applicable land disposal restriction treatment standards, no further treatment prior to land disposal is required as a condition of the LDRs.

An opportunity for the public to review and comment on tentative TU approvals is required by the regulations when TUs are approved using permitting procedures and as a matter of EPA policy when TUs are approved using orders. As with CAMUs, EPA recommends that whenever possible, remediation project managers combine this public participation with other public involvement activities that are typically part of remediation. For example, public notice of tentative approval of a temporary unit could be combined with public notice of a proposed plan under CERCLA.

The TU regulations are at 40 CFR 264.553, promulgated February 16, 1993 (58 FR 8658).

**Determination Of When Contamination is Caused by Listed Hazardous Waste.** Where a facility owner/operator makes a good faith effort to determine if a material is a listed hazardous waste but cannot make such a determination because documentation regarding a source of contamination, contaminant, or waste is unavailable or inconclusive, EPA has stated that one may assume the source, contaminant or waste is not listed hazardous waste and, therefore, provided the material in question does not exhibit a characteristic of hazardous waste, RCRA requirements do not apply. This approach was first articulated in the Proposed NCP preamble which notes that it is often necessary to know the source of a waste (or contaminant) to determine whether a waste is a listed hazardous waste under RCRA<sup>1</sup> and also notes that, "at many CERCLA sites no information exists on the source of the wastes."

The proposed NCP preamble goes on to recommend that the lead agency use available site information such as manifests, storage records and vouchers in an effort to ascertain the sources of wastes or contaminants, but that when this documentation is not available or inconclusive the lead agency may assume that the wastes (or contaminants) are not listed RCRA hazardous wastes. This approach was confirmed in the final NCP preamble. See, 53 FR 51444, December 21, 1988 for proposed NCP preamble discussion; 55 FR 8758, March 13, 1990 for final NCP preamble discussion.

This approach was also discussed in the HWIR-Media proposal preamble, 61 FR 18805, April 29, 1996, where it was expanded to also cover dates of waste disposal – i.e., if, after a good faith effort to determine dates of disposal a facility owner/operator is unable to make such a determination because documentation of dates of disposal is unavailable or inconclusive, one may assume disposal occurred

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<sup>1</sup> Listing determinations are often particularly difficult in the remedial context because the listings are generally identified by the sources of the hazardous wastes rather than the concentrations of various hazardous constituents; therefore, analytical testing alone, without information on a waste's source, will not generally produce information that will conclusively indicate whether a given waste is a listed hazardous waste.

prior to the effective date of applicable land disposal restrictions. This is important because, if hazardous waste was originally disposed of before the effective dates of applicable land disposal restrictions and media contaminated by the waste are determined not to contain hazardous waste when first generated (i.e., removed from the land, or area of contamination), the media are not subject to RCRA requirements, including LDRs. See the discussion of the contained-in policy, below.

**Site Specific LDR Treatment Variances.** The regulations for site-specific LDR treatment variances allow EPA and authorized states to establish a site-specific LDR treatment standard on a case-by-case basis when a nationally applicable treatment standard is unachievable or inappropriate. Public notice and a reasonable opportunity for public comment must be provided before granting or denying a site-specific LDR treatment variance. EPA recommends that remediation project managers combine this public involvement with other public involvement activities that are typically part of remediation. Regulations governing site-specific LDR treatment variances are at 40 CFR 268.44(h), promulgated August 17, 1988 (53 FR 31199) and clarified December 5, 1997 (62 FR 64504). The most recent EPA guidance on site-specific LDR treatment variances, which includes information on establishing alternative LDR treatment standards, is in the January 8, 1997 guidance memo, "Use of Site-Specific Land Disposal Restriction Treatability Variances Under 40 CFR 268.44(h) During Cleanups."

In 1996, EPA revised its policy on state authorization for site-specific LDR treatment variances and began encouraging states to become authorized to approve variances. See, HWIR-Media proposal, 61 FR 18828 (April 29, 1996).

On May 26, 1998, EPA promulgated additional site-specific land disposal restriction treatment variance opportunities specific to hazardous contaminated soil. These opportunities are discussed below.

**Treatability Studies Exemption.** The term "treatability study" as defined at 40 CFR 260.10 refers to a study in which a hazardous waste is subjected to a treatment process to determine: (1) whether the waste is amenable to the treatment process; (2) what pretreatment (if any) is required; (3) the optimal process conditions needed to achieve the desired treatment; (4) the efficiency of a treatment process for a specific waste or wastes; or, (5) the characteristics and volumes of residuals from a particular treatment process. Under regulations at 40 CFR 261.4(e) and (f), hazardous wastes managed during a treatability study are exempt from many RCRA Subtitle C requirements. The regulations limit the amount of waste that may be managed under an exempt treatability study to, generally, 1000 kg of hazardous waste or 1 kg of acutely hazardous waste per study. For contaminated environmental media, the volume limit is, generally, 10,000 kilograms of media that contain non-acutely hazardous waste and 2,500 kilograms of media that contain acutely hazardous waste per study. There are also limits on the types and lengths of studies that may be conducted under the exemption and record keeping and reporting requirements. Regulations governing treatability studies are at 40 CFR 261.4(e) and (f), associated preamble discussions at 52 FR 27290 (July 19, 1988) and 59 FR 8362 (February 18, 1994).

**Exemption for Ninety Day Accumulation.** Management of hazardous waste in tanks, containers, drip pads and containment buildings does not constitute land disposal. In addition, EPA has

provided an exemption for generators of hazardous waste which allows them to accumulate (i.e., treat or store) hazardous waste at the site of generation in tanks, containers, drip pads or containment buildings for up to ninety days without RCRA interim status or a RCRA permit. Accumulation units must meet applicable design, operating, closure and post-closure standards. Because putting hazardous waste in a tank, container, drip pad or containment building is not considered land disposal, LDR treatment standards do not have to be met before putting waste in such units. LDRs must be met if hazardous wastes are eventually land disposed, for example, after they are removed from the accumulation unit; however, if treatment in an accumulation unit results in constituent concentrations that comply with applicable land disposal restriction treatment standards, no further treatment prior to land disposal is required as a condition of the LDRs. The exemption for ninety-day accumulation is found in regulations at 40 CFR 262.34; associated preamble discussion is at 51 FR at 10168 (March 24, 1986).

**Permit Waivers.** Under CERCLA Section 121(e), no Federal, state or local permit is required for on-site CERCLA response actions. EPA has interpreted CERCLA Section 121(e) to waive the requirement to obtain a permit and associated administrative and procedural requirements of permits, but not the substantive requirements that would be applied through permits.<sup>2</sup>

In addition, on a case-by-case basis, where there may be an imminent and substantial endangerment to human health or the environment, EPA has broad authority to require corrective action and other appropriate activities under RCRA Section 7003. Under RCRA Section 7003, EPA has the ability to waive both the requirement to obtain a permit and the substantive requirements that would be imposed through permits. When EPA uses RCRA Section 7003, however, the Agency seldom uses RCRA Section 7003 to waive substantive requirements. In rare situations where substantive requirements are waived, the Agency would impose alternative requirements (e.g., waste treatment or storage requirements) as necessary to ensure protection of human health and the environment. EPA may issue RCRA Section 7003 orders at, among other sites, facilities that have been issued RCRA permits and facilities that are authorized to operate under RCRA interim status. In discussing the use of 7003 orders, where other permit authorities are available to abate potential endangerments, EPA generally encourages use of those other permit authorities (e.g., 3005(c)(3) omnibus permitting authority) rather than RCRA Section 7003. Similarly, if RCRA Section 3008(h) or RCRA Section 3013 authority is available, EPA generally encourages use of these authorities rather than RCRA Section 7003. If permit authorities or non-RCRA Section 7003 enforcement authorities are inadequate, cannot be used to address the potential endangerment in a timely manner, or are otherwise inappropriate for the potential endangerment at issue, use of RCRA Section 7003 should be considered. See, "Guidance on the Use of Section 7003 of RCRA," U.S. EPA, Office of Enforcement and Compliance Assurance, October 1997.

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<sup>2</sup> Note that, under certain circumstances, substantive requirements may be waived using CERCLA. See the ARAR waiver provisions at 40 CFR 300.430(f)(1)(ii)(C).

In 1987, EPA issued guidance indicating that RCRA-authorized states with state waiver authorities comparable to CERCLA 121(e) or RCRA Section 7003 could use those state waiver authorities to waive RCRA requirements as long as the state did so in a manner no less stringent than that allowed under the corresponding Federal authorities. These waivers are most often used, as are the Federal waivers, to obviate the need to obtain a RCRA permit, rather than to eliminate substantive requirements. See, EPA guidance memo from J. Winston Porter to EPA Regional Administrators, "RCRA Permit Requirements for State Superfund Actions," November 16, 1987, OSWER Directive 9522.00-2.

**Exemption from 40 CFR Part 264 Requirements for People Engaged in the Immediate Phase of a Spill Response.** Regulations at 40 CFR 264.1(g)(8) provide that people engaged in treatment or containment activities are not subject to the requirements of 40 CFR part 264 if the activities are carried out during immediate response to: (1) a discharge of hazardous waste; (2) an imminent and substantial threat of a discharge of hazardous waste; (3) a discharge of a materials which, when discharged, becomes a hazardous waste; or, (4) an immediate threat to human health, public safety, property or the environment from the known or suspected presence of military munitions, other explosive material, or an explosive device. This means that, during the immediate phase of a spill response, hazardous waste management activities do not require hazardous waste permits (or interim status) and hazardous waste management units used during immediate response actions are not subject to RCRA design, operating, closure or post-closure requirements.

Of course, if hazardous waste treatment activities or other hazardous waste management activities continue after the immediate phase of a spill response is over, all applicable hazardous waste management and permitting requirements would apply. In addition, if spills occur at a facility that is already regulated under 40 CFR part 264, the facility owner/operator must continue to comply with all applicable requirements of 40 CFR Part 264 Subparts C (preparedness and prevention) and D (contingency plan and emergency procedures). See regulations at 40 CFR 260.1(g) and associated preamble discussion at 45 FR 76626 (November 19, 1980). See also, Sept. 29, 1986 memo from J. Winston Porter (EPA Assistant Administrator) to Fred Hansen interpreting the 40 CFR 264.1(g) regulations.

**Changes During Interim Status to Comply with Corrective Action Requirements.**

Under regulations at 40 CFR 270.72(a)(5), an owner or operator of an interim status facility may make changes to provide for treatment, storage and disposal of remediation wastes in accordance with an interim status corrective action order issued by EPA under RCRA Section 3008(h) or other Federal authority, by an authorized state under comparable state authority, or by a court in a judicial action brought by EPA or an authorized state. These changes are limited to treatment, storage and disposal of remediation waste managed as a result of corrective action for releases at the facility in question; however, they are exempt from the reconstruction ban under 40 CFR 270.72(b). Under this provision, for example, EPA could approve a corrective action management unit for treatment of remediation waste using a 3008(h) order (or an authorized state could approve a CAMU using a similar state authority), even if that unit would otherwise amount to "reconstruction." Of course, units added at interim status facilities in accordance with this provision must meet all applicable unit requirements; for example, in the case of a CAMU, the CAMU requirements apply. See, regulations at 40 CFR 270.72(a)(5) promulgated March 7, 1989 and associated preamble discussion at 54 FR 9599.

**Emergency Permits.** In the event of an imminent and substantial endangerment to human health or the environment, EPA, or an authorized state, may issue a temporary emergency permit for treatment, storage or disposal of hazardous waste. Emergency permits may allow treatment, storage or disposal of hazardous waste at a non-permitted facility or at a permitted facility for waste not covered by the permit. Emergency permits may be oral or written. (If oral, they must be followed within five days by a written emergency permit.) Emergency permits must specify the hazardous wastes to be received and managed and the manner and location of their treatment, storage and disposal. Emergency permits may apply for up to ninety days, but may be terminated at any point if EPA, or an authorized state, determines that termination is appropriate to protect human health or the environment. Emergency permits must be accompanied by a public notice that meets the requirements of 40 CFR 124.10(b), including the name and address of the office approving the emergency permit, the name and location of the hazardous waste treatment, storage or disposal facility, a brief description of the wastes involved, the actions authorized and the reason for the authorization, and the duration of the emergency permit.

Emergency permits are exempt from all other requirements of 40 CFR part 270 and part 124; however, to the extent possible and not inconsistent with the emergency situation, they must incorporate all otherwise applicable requirements of 40 CFR part 270 and parts 264 and 266.

See, regulations at 40 CFR 270.61, originally promulgated as 40 CFR 122.27 on May 19, 1987 (45 FR 33326). EPA has also written a number of letters interpreting the emergency permit regulations, see, for example, November 3, 1992 letter to Mark Hansen, Environmental Products and Services Inc., from Sylvia Lowrance, Director Office of Solid Waste (available in the RCRA Permit Policy Compendium).

**Temporary Authorizations at Permitted Facilities.** Under regulations at 40 CFR 270.42(e), EPA, or an authorized state, may temporarily authorize a permittee for an activity that would be the subject of a class two or three permit modification in order to, among other things, facilitate timely implementation of closure or corrective action activities. Activities approved using a temporary authorization must comply with applicable requirements of 40 CFR part 264. Temporary authorizations are limited to 180 days, with an opportunity for an extension of 180 additional days. To obtain an extension of a temporary authorization, a permittee must have requested a class two or three permit modification for the activity covered in the temporary authorization. Public notification of temporary authorizations is accomplished by the permittee sending a notice about the temporary authorization to all persons on the facility mailing list and to appropriate state and local governments. See regulations at 40 CFR 270.42, promulgated on September 28, 1988, and associated preamble at 53 FR 37919.

### **Regulations and Policies that Apply to Contaminated Environmental Media Only**

**Contained-in policy.** Contaminated environmental media, of itself, is not hazardous waste and, generally, is not subject to regulation under RCRA. Contaminated environmental media can become subject to regulation under RCRA if they "contain" hazardous waste. As discussed more fully below, EPA generally considers contaminated environmental media to contain hazardous waste: (1) when they exhibit a characteristic of hazardous waste; or, (2) when they are contaminated with concentrations of hazardous constituents from listed hazardous waste that are above health-based levels.

If contaminated environmental media contain hazardous waste, they are subject to all applicable RCRA requirements until they no longer contain hazardous waste. EPA considers contaminated environmental media to no longer contain hazardous waste: (1) when they no longer exhibit a characteristic of hazardous waste; and (2) when concentrations of hazardous constituents from listed hazardous wastes are below health-based levels. Generally, contaminated environmental media that do not (or no longer) contain hazardous waste are not subject to any RCRA requirements; however, as discussed below, in some circumstances, contaminated environmental media that contained hazardous waste when first generated (i.e., first removed from the land, or area of contamination) remain subject to LDR treatment requirements even after they "no longer contain" hazardous waste.

The determination that any given volume of contaminated media does not contain hazardous waste is called a "contained-in determination." In the case of media that exhibit a characteristic of hazardous waste, the media are considered to "contain" hazardous waste for as long as they exhibit a characteristic. Once the characteristic is eliminated (e.g., through treatment), the media are no longer considered to "contain" hazardous waste. Since this determination can be made through relatively straightforward analytical testing, no formal "contained-in" determination by EPA or an authorized state is required. Just like determinations about whether waste has been adequately decharacterized, generators of contaminated media may make independent determinations as to whether the media exhibit a characteristic of hazardous waste. In the case of media that are contaminated by listed hazardous waste, current EPA guidance recommends that contained-in determinations be made based on direct exposure using a reasonable maximum exposure scenario and that conservative, health-based, standards be used to develop the site-specific health-based levels of hazardous constituents below which contaminated environmental media would be considered to no longer contain hazardous waste. Since this determination involves development of site-specific health-based levels, the approval of EPA or an authorized state is required.

In certain circumstances the, RCRA land disposal restrictions will continue to apply to contaminated media that has been determined not to contain hazardous waste. This is the case when contaminated media contain hazardous waste when they are first generated (i.e., removed from the land, or area of contamination) and are subsequently determined to no longer contain hazardous waste (e.g., after treatment), but still contain hazardous constituents at concentrations above land disposal restriction treatment standards. It is also the case when media are contaminated as a result of disposal of untreated (or insufficiently treated) listed hazardous waste after the effective date of an applicable LDR treatment requirement. Of course, if no land disposal will occur (e.g., the media will be legitimately recycled) the LDR treatment standards do not apply. In addition, contaminated environmental media determined not to contain any waste (i.e., it is just media, it does not contain solid or hazardous waste) would not be subject to any RCRA Subtitle C requirements, including the LDRs, regardless of the time of the "contained-in" determination.

The contained-in policy was first articulated in a November 13, 1986 EPA memorandum, "RCRA Regulatory Status of Contaminated Groundwater." It has been updated many times in Federal Register preambles, EPA memos and correspondence, see, e.g., 53 FR 31138, 31142, 31148 (Aug. 17, 1988), 57 FR 21450, 21453 (May 20, 1992), and detailed discussion in HWIR-Media proposal preamble, 61 FR 18795 (April 29, 1996). A detailed discussion of the continuing requirement that



some soils which have been determined to no longer contain hazardous waste (but still contain solid waste) comply with land disposal treatment standards can be found in the HWIR-Media proposal preamble, 61 FR 18804; the September 15, 1996 letter from Michael Shapiro (EPA OSW Director) to Peter C. Wright (Monsanto Company); and the preamble to the LDR Phase IV rule, 63 FR 28617 (May 26, 1998).

Note that the contained-in policy applies only to environmental media (soil, ground water, surface water and sediments) and debris. The contained-in policy for environmental media has not been codified. As discussed below, the contained-in policy for hazardous debris was codified in 1992.

#### **RCRA Section 3020(b) Exemption for Reinjection of Contaminated Ground Water.**

Under RCRA Section 3020(a), disposal of hazardous waste into or above a formation that contains an underground source of drinking water is generally prohibited. RCRA Section 3020(b) provides an exception for underground injection carried out in connection with certain remediation activities. Under RCRA Section 3020(b), injection of contaminated ground water back into the aquifer from which it was withdrawn is allowed if: (1) such injection is conducted as part of a response action under Section 104 or 106 of CERCLA or a RCRA corrective action intended to clean up such contamination; (2) the contaminated ground water is treated to substantially reduce hazardous constituents prior to reinjection; and, (3) the response action or corrective action will, on completion, be sufficient to protect human health and the environment. Approval of reinjection under RCRA Section 3020(b) can be included in approval of other cleanup activities, for example, as part of approval of a RCRA Statement of Basis or CERCLA Record of Decision. See, RCRA Section 3020(b), established as part of the 1984 HSWA amendments. See also, OSWER Directive 9234.1-06, "Applicable of Land Disposal Restrictions to RCRA and CERCLA Ground Water Treatment Reinjection Superfund Management Review: Recommendation No. 26," November 27, 1989.

**LDR Treatment Standards for Contaminated Soils.** On May 26, 1998, EPA promulgated land disposal restriction treatment standards specific to contaminated soils.<sup>3</sup> These treatment standards require that contaminated soils which will be land disposed be treated to reduce concentrations of hazardous constituents by 90 percent or meet hazardous constituent concentrations that are ten times the universal treatment standards (UTS), whichever is greater. (This is typically referred to as 90% capped by 10xUTS.) For contaminated soil that exhibits a characteristic of ignitable, reactive or corrosive hazardous waste, treatment must also eliminate the hazardous characteristic.

The soil treatment standards apply to all underlying hazardous constituents<sup>4</sup> reasonably expected to be present in any given volume of contaminated soil when such constituents are found at initial concentrations greater than ten times the UTS. For soil that exhibits a characteristic of toxic, ignitable, reactive or corrosive hazardous waste, treatment is also required for: (1) in the case of the toxicity

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<sup>3</sup> This rule, which also addresses a number of non-soil issues, has been challenged by a number of parties. To date, the parties have filed non-binding statements of issues only; however, based on those statements, it appears that, with the exception of the requirement that PCBs be included as an underlying hazardous constituent which has been challenged for both soil and non-soil wastes, the soil treatment standards are not included in the challenges.

<sup>4</sup> Except fluoride, selenium, sulfides, vanadium and zinc.

characteristic, the characteristic constituent; and, (2) in the case of ignitability, reactivity or corrosivity, the characteristic property. Although treatment is required for each underlying hazardous constituent, it is not necessary to monitor soil for the entire list of underlying hazardous constituents. Generators of contaminated soil can reasonably apply knowledge of the likely contaminants present and use that knowledge to select appropriate underlying hazardous constituents, or classes of constituents, for monitoring. As with the LDR treatment standards for hazardous debris (discussed below), generators of contaminated soil may use either the applicable universal treatment standards for the contaminating hazardous waste or the soil treatment standards.

See, soil treatment standard regulations at 40 CFR 268.49, promulgated May 26, 1998 and associated preamble discussion at 63 FR 28602-28622.

Note that the soil treatment standards supersede the historic presumption that an LDR treatment variance is appropriate for contaminated soil. LDR treatment variances are still available for contaminated soil, provided the generator can show that an otherwise applicable treatment standard (i.e., the soil treatment standard) is unachievable or inappropriate, as discussed above, or can show that a site-specific, risk-based treatment variance is proper, as discussed below.

**Site-Specific, Risk-Based LDR Treatment Variance for Contaminated Soils.** On May 26, 1998, EPA promulgated a new land disposal restriction treatment variance specific to contaminated soil. Under 40 CFR 268.44(h)(3), variances from otherwise applicable LDR treatment standards may be approved if it is determined that compliance with the treatment standards would result in treatment beyond the point at which short- and long-term threats to human health and the environment are minimized. This allows a site-specific, risk-based determination to supersede the technology-based LDR treatment standards under certain circumstances.

Alternative land disposal restriction treatment standards established through site specific, risk-based minimize threat variances should be within the range of values the Agency generally finds acceptable for risk-based cleanup levels. That is, for carcinogens, alternative treatment standards should ensure constituent concentrations that result in the total excess risk to an individual exposed over a lifetime generally falling within a range from  $10^{-4}$  to  $10^{-6}$ , using  $10^{-6}$  as a point of departure and with a preference for achieving the more protective end of the risk range. For non-carcinogenic effects, alternative treatment standards should ensure constituent concentrations that an individual could be exposed to on a daily basis without appreciable risk of deleterious effect during a lifetime; in general, the hazard index should not exceed one (1). Constituent concentrations that achieve these levels should be calculated based on a reasonable maximum exposure scenario -- that is, based on an analysis of both the current and reasonable expected future land uses, with exposure parameters chosen based on a reasonable assessment of the maximum exposure that might occur; however, alternative LDR treatment standards may not be based on consideration of post-land disposal controls such as caps or other barriers.

See, regulations at 40 CFR 268.44(h)(4), promulgated May 26, 1998 and associated preamble discussion at 63 FR 28606-28608.

## **Regulations and Policies that Apply Only to Debris**

**LDR Treatment Standards for Contaminated Debris.** In 1992, EPA established land disposal restriction treatment standards specific to hazardous contaminated debris. The debris-specific treatment standards established by these regulations are based on application of common extraction, destruction, and containment debris treatment technologies and are expressed as specific technologies rather than numeric criteria. As with the contaminated soil treatment standards discussed earlier, generators of hazardous contaminated debris may choose between meeting either the debris treatment standards or the numerical treatment standard promulgated for the contaminating hazardous waste. See, regulations at 40 CFR 268.45, promulgated August 18, 1992, and associated preamble discussion at 57 FR 37194 and 27221.

**Interpretation that Debris Treated to the LDR Debris Treatment Standards Using Extraction or Destruction Technologies no Longer Contain Hazardous Waste.** With the land disposal restriction treatment standards for hazardous contaminated debris, in 1992, EPA determined that hazardous debris treated to comply with the debris treatment standards using one of the identified extraction or destruction technologies would be considered no longer to contain hazardous waste and would, therefore, no longer be subject to regulation under RCRA, provided the debris do not exhibit any of the hazardous waste characteristics. This "contained-in determination" is automatic; no agency action is needed. Note that this automatic contained-in determination does not apply to debris treated to the debris treatment standards using one of the identified immobilization technologies. See, regulations at 40 CFR 261.3(f) and treatment standards at Table 1 of 40 CFR 268.45, promulgated August 18, 1992, and associated preamble discussion at 51 FR 37225.

cc: Barbara Simcoe, Association of State and Territorial Solid Waste Management Officials

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460**

OFFICE OF  
SOLID WASTE AND EMERGENCY  
RESPONSE

Doug MacMillan, Executive Director  
Environmental Technology Council  
734 15th Street NW, Suite 720  
Washington, DC 20005

Dear Mr. MacMillan:

Thank you for your letter of January 8, 1997 expressing concern about potential changes to the Resource Conservation and Recovery Act (RCRA) as it relates to regulation of remediation wastes. As you know through participation in development of the Hazardous Waste Identification Rule for Contaminated Media (HWIR-Media) and discussions of the remediation waste proposals before the 104th Congress, EPA has long believed that changes in application of certain RCRA requirements to remediation waste are appropriate. While the Agency has not endorsed any specific legislative proposal, we continue to believe reform to application of RCRA requirements to remediation waste, especially RCRA land disposal restrictions, minimum technology, and permitting requirements, if accomplished appropriately, could significantly accelerate cleanup actions at Superfund, Brownfield, and RCRA Corrective Action sites without sacrificing protection of human health or the environment. We are committed to continuing and improving our dialogue on this issue with all stakeholders and are hopeful that remaining technical and policy concerns can be resolved so meaningful reform can proceed as soon as possible.

Your letter suggests we may differ on the scope of the reforms we are attempting to achieve through the HWIR-Media proposal. The changes to RCRA regulations proposed in HWIR-Media address application of RCRA requirements to remediation wastes that are being managed; they do not address cleanup standards or remedy selection criteria. Under the HWIR-Media proposal, and the alternative approaches discussed in the proposal, decisions governing whether or not to manage any given remediation waste would continue to be resolved through applicable Federal or state remedy selection criteria. We recognize that this distinction may seem artificial; however, we believe it is important to emphasize that our fundamental goal in HWIR-Media is to tailor RCRA management standards for remediation waste already caught

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v the RCRA hazardous waste regulatory system, rather than impose RCRA cleanup standards on Federal, state or private cleanups not currently subject to RCRA.

Thank you again for your interest and continued assistance in development and resolution of many, complicated issues associated with RCRA remediation waste reform. If you have any questions or would like to discuss these issues further, please feel free to contact me or Elizabeth McManus, of my staff, at (703) 308-8657.

Sincerely Yours,

Michael Shapiro, Director  
Office of Solid Waste

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United States Environmental Protection Agency  
Washington, D.C. 20460  
Office of Solid Waste and Emergency Response

September 26, 1990

MEMORANDUM

SUBJECT: Consultation with Region V on ARAR Waiver for  
Moss American Site

FROM: Henry L. Longest II, Director Office of  
Emergency and Remedial Response

TO: Norman Niedergang, Associate Director, Waste  
Management Division, Region V

Purpose

The purpose of this memorandum is to follow-up the consultation held with Region V on August 28, 1990, on the Moss American Site in Milwaukee, Wisconsin. The purpose of the consultation was to discuss a waiver of the Subtitle C impermeable cap required for on-site containment of RCRA K001 (wood preserving wastes) treatment residues. Based on our discussion, Region V will waive the Subtitle C cap because a permeable cap will enhance ground-water treatment.

Another issue raised by Region V during the consultation concerns whether disposal of treated wastes from the Northeast Landfill area of the site must occur in a unit meeting the minimum technological requirements of RCRA. This memorandum clarifies that these wastes may be disposed in the existing unit (area of contamination) across the river from the Northeast Landfill, which, after receipt of the treated wastes will be closed, and RCRA standards that are applicable or relevant and appropriate requirements (ARARs) will be attained (unless a statutory waiver is justified). Such consolidation does not trigger the minimum technological requirements of RCRA.

Background

Region V is seeking a waiver from the requirement to install a Subtitle C impermeable cap on a landfill that will contain K001 RCRA wastes treated to meet the treatment standards under the land disposal restrictions (through a treatability variance). A permeable cap will enhance ground-water treatment while preventing direct contact with treatment residues. The permeable cap will enable ground-water treatment to occur in a period of seven to ten years rather than 200 years, the estimated timeframe necessary if an impermeable cap is installed. Because of the unique site characteristics and the remedy selected, installation of a Subtitle C impermeable cap, therefore, would result in greater risk to health and the environment by preventing natural flushing and significantly delaying and reducing the effectiveness of ground-water remediation. The Region should include performance standards in the Record of Decision (ROD) to verify the protectiveness of the remedy.

During the consultation, Region V also raised a question related to disposal of K001 waste from the Northeast Landfill area of contamination. The Region intends to move these wastes (approximately 1000 cubic yards) across the Little Menomonee River, treat them in compliance with the land disposal restrictions (through a treatability variance), dispose of them on-site in an existing unit (the area of contamination (AOC) southwest of the river), and clean close the Northeast Landfill area. Based on its understanding of the RCRA closure requirements, the Region had proposed disposing of these wastes in a unit meeting the minimum technological requirements of RCRA in the Proposed Plan for the site.

The Region questioned this requirement during the consultation due to the resulting effect: a hazardous waste landfill meeting the minimum technological requirements of RCRA would be constructed in a previously uncontaminated area of the site, next to an existing unit meeting RCRA ARARs, and both units would contain K001 wastes treated to the same levels. Specifically, the Region's question concerns whether disposal of the Northeast Landfill waste must occur in a minimum technological unit under the RCRA closure requirements, or whether the waste may be disposed in the existing unit/AOC, which, upon closure, will attain (or waive) RCRA ARARs.

Since the consultation, it has been determined that the Northeast Landfill waste may be disposed in the existing unit/AOC without triggering the minimum technological requirements of RCRA. Such disposal may occur because the AOC is an existing unit (see

footnote 1) and does not meet the definition of any of the following units which must meet the minimum technological requirements: a new unit, a unit that has been laterally expanded, or a replacement unit. It is clear that the original area of contamination is not a new unit, nor is it being laterally expanded. The question, then, is whether the unit would be considered a replacement unit.

A replacement unit is defined as a unit "that is taken out of service and emptied by removing all or substantially all waste from it." (50 FR 28706, July 15, 1985) (see footnote 2). The existing unit/AOC at the Moss American site would only be considered a replacement unit if all or significantly all of the waste had been removed from the unit and new waste subsequently disposed there. The intent of a replacement unit is that once a unit has been taken out of service and the waste removed, before the unit may be put back into service, the unit must be retrofit to meet the minimum technological requirements.

The existing unit/AOC at the Moss American site, therefore, does not fit the definition or intent of a replacement unit. Rather, the waste in the existing unit/AOC will be treated in place using bioremediation (in compliance with the land disposal restrictions) and returned to the unit which will later be closed, and RCRA ARARs will be attained (or waived). Wastes from the Northeast Landfill area will also be treated and consolidated with the wastes in the existing unit/AOC. This consolidation will occur in an existing unit (the original area of contamination), without lateral expansion of the unit. Furthermore, this AOC will not fit the definition of a new or replacement unit, as discussed above. The status of the existing unit/AOC will not change, and therefore will not be required to meet the minimum technological requirements.

## Implementation

Based on our discussion, the Region will waive the requirement to install a Subtitle C impermeable cap based on greater risk to health and the environment, and will emphasize in the Record of Decision that the permeable cap actually acts as part of the treatment system, enhancing its effectiveness.

The Region will also state in the ROD that the Northeast Landfill wastes will be disposed in the original area of contamination in compliance with the land disposal restrictions.



cc: John Kelley (Region V, RERB); Jon Dikinis (Region V, M&WI Section); Doug Ballotti (Region V, Unit 39); Betty L. (Region V, RPM); Paul Nadeau (HSCD); Bill Hanson (ROGB); Tim Mott (OWPE); Robin Anderson (ROGB); Steve Golian (ROGR); Andrea McLaughlin (ROGB); Ernest Watkins (OWPE)

1 See preamble to 1990 NCP, 55 FR 8760 (March 8, 1990). ("EPA believes that it is appropriate generally to consider CERCLA areas of contamination as a single RCRA land-based unit or 'landfill'.")

2 CERCLA guidance defines as a replacement unit, an existing unit where: "(1) the unit is taken out of service; (2) all or substantially all of the waste is removed; and (3) the unit is reused, which does not include removal and replacement of waste into the same unit." OSWER Directive No. 9234.2-04FS (October 1989), "RCRA ARARs," page 6.

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9/10/1993(06)

United States Environmental Protection Agency  
Washington, D.C. 20460  
Office of Solid Waste and Emergency Response

October 12, 1993

Dr. Ed L. Schrader  
Associate Professor  
Director of Sorbent Laboratory  
Millsaps College  
1701 North State Street  
Jackson, Mississippi 39210-0001

SUBJECT: Paint Filter Liquids Test Technical Guidance

Dear Dr. Schrader:

Thank you for your letter of February 4, 1993, and our subsequent discussions in which you raised questions about the applicability of the Paint Filter Liquids Test (PFT, Method 9095) to the sorbent industry. The test determines if a free liquid exists for the purposes of the Liquids in Landfills Rule.

Five items in particular seem to be of concern to sorbent manufacturers, users, and landfill operators in complying with the Liquids in Landfills Rule: (1) the light bulk density of some sorbents, which causes them to overflow the filter, (2) the need for clarifying that sorbents and sorbates are to be uniformly mixed prior to placement in the paint filter, (3) the size and shape of sorbent pillows, socks, and pads, which prevents them from fitting into the paint filter without modification, (4) the need to standardize filter paper specifications, and (5) the need to test each sorbate/sorbent combination.

With regard to the first item, if a 100-g sample of sorbent is of such low density that it would overflow the filter (potentially causing liquids to flow between the filter and funnel, yielding a false positive), then two options exist. First, the procedure specifies a "100-ml or 100-g representative sample," so a 100-ml rather than a 100-g sample may be used, if the material can be measured volumetrically (i.e., lacks major air spaces or voids). Second, the sides of the filter can be extended upward by taping a similar paper to the inside of the filter paper (so any flow will stay within the filter) and above the mesh. In either case, sealing the sample into the paint filter may be facilitated by lightly tapping the side of the filter as it is being filled.

Regarding the second item, liquid should not be poured over the sorbent after the sorbent has been placed in the paint filter. The sorbent and liquid material should be thoroughly and uniformly mixed and then a representative sample placed in the filter.

Regarding the third item, the PFT does not address how material such as sorbent pillows, socks, pads, sheets, and rolls should be placed into the paint filter. How such items are placed into the filter could result in significant variations in test results. As this is a gravity test with no external applied pressure, it is not intended for sorbent pillows, socks, etc. to be squeezed or compressed to fit into the paint filter.

In order to assure uniformity and standardization of the test, a 100-g or 100-ml sample of sorbent pad, roll, sheet, or other material which does not conform to the shape of the paint filter, should be cut into small pieces and poured into the filter. Sample size reduction may be accomplished by cutting the sorbent material with scissors, shears, knife, or other such device so as to preserve as much of the original integrity of the sorbent fabric as possible. Sorbents enclosed in a fabric should be mixed with the resultant fabric pieces. The particles to be tested should be reduced smaller than 1 cm (i.e., should be capable of passing through a 9.5 mm (0.375 inch) standard sieve). Grinding sorbent materials should be avoided as this may destroy the integrity of the sorbent and produce many "fine particles" which would normally not be present.

For brittle materials larger than 1 cm that do not conform to the filter, light crushing to reduce oversize particles is acceptable if it is not practical to cut the material. Materials such as clay, silica gel, and some polymers may fall into this category.

Regarding the fourth item, the PFT specifies "Conical paint filter: Mesh number 60 (fine meshed size). Available at local paint stores such as Sherwin-Williams and Glidden for an approximate cost of \$0.07 each [as of September 1986]." EPA recognizes that most paint filters today are not labelled by actual mesh size, and that the specified "fine meshed size" available commercially is actually a mesh size of 60 X 48 threads or holes/inch. Since this is coarser than a 60 X 60 mesh, it has the potential to give more conservative test results (i.e., may fail more samples) and is therefore acceptable to EPA, as would be a 60 X 60 mesh. Mesh sizes greater (i.e., finer) than 60 X 60, however, would not be acceptable.

Regarding the fifth item, no materials, whether sorbed or not, may be placed in a hazardous waste landfill if they release free li as determined by the PFT. This should be implemented through the landfill operator's Waste Analysis Plan (WAP). The WAP should identify when samples will be tested using the PFT. In cases

of controlled treatment by sorbents, it may not be necessary to test each treated sample if sufficient data have been obtained by testing each sorbate/sorbent combination to establish the loading ratio that assures no free liquids, and the treatment is done to assure such ratios are not exceeded. Each sorbate/sorbent combination should be tested because sorbents have different sorption characteristics and sorption ratios based on the type of sorbate (e.g., oily vs water-based sorbates).

As we discussed, this test is not designed to evaluate the efficiency of a sorbent product relative to other sorbents. It is designed to determine if a specific sample, be it sorbent or other material, contains free liquid and thus should not be placed in a hazardous waste landfill. As discussed under item 5 above, the PFT may also be used to determine the "saturation" or pass/fail level of a particular sorbent/sorbate combination. Our testing shows that at the "saturation" level some failures may occur since the "saturation" level is more a range than a line, but that at some lower liquid loading level, that can be determined in the lab, passing the PFT is consistently achieved. This knowledge is invaluable to a treater using sorbents to assure successful treatment (i.e., a high pass rate). It is less valuable when sorbents are used to control or clean up spills since sorbate/sorbent ratios are less controlled.

I hope this information will help clarify technical details about the applicability of the Paint Filter Liquids Test to sorbents and assist you in your analytical program. EPA plans to incorporate appropriate parts of this technical guidance into Method 9095 when we propose a third update to the third edition of SW-846. Realistically the proposal and promulgation of this update is several years away, so I hope this technical guidance will serve your purposes in the interim.

Sincerely,  
 Oliver M. Fordham, Jr.  
 National Inorganic Program Manager for RCRA

cc:  
 David Bussard, Mike Flynn, Alec McBride, Gail Hansen, Tom Beisswenger, Matt Hale, Ken Shuster, Dave Eberly, RCRA Hotline

□

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## Hotline Questions and Answers

January 1995

## 1. The Liquids in Landfills Prohibition and Sorbed Free Liquids

EPA prohibits the direct placement in a hazardous waste landfill of liquid hazardous waste or hazardous waste containing free liquids (40 CFR □264/265.314(b)). The Agency also prohibits the placement in a hazardous waste landfill of containers holding free liquids, except for lab packs, very small containers (i.e., ampules) and containers designed to hold free liquids for use other than storage (i.e. batteries)(□264.314(d)(2), (3), and (4) and □265.314(c)(2), (3), and (4)). On November 18, 1992 (57 FR 54454), the Agency retained the Paint Filter Liquids Test (PFT) as the required test to determine if hazardous wastes hold free liquids. If the PFT demonstrates that a waste to which sorbents have been added no longer contains free liquids, may the waste be placed in a landfill or is additional treatment required?

EPA criteria for the use of sorbents to treat wastes containing free liquids vary according to whether the wastes will be disposed of directly or will be placed in a container prior to disposal. EPA allows the use of sorbents to remove free liquids from "containerized" wastes. If the PFT demonstrates that a containerized waste to which sorbents have been added contains no free liquids, the waste may be disposed of in a hazardous waste landfill (40 CFR □264.314(d)(1)(ii) and □265.314(c)(1)(ii)), provided that it all meets all applicable land disposal restriction (LDR) treatment standards. As a precaution against the use of inadequate sorbents, EPA regulations require that sorbents used to treat free liquids prior to land disposal be nonbiodegradable (40 CFR □264.314(e) and □265.314(f)).

EPA prohibits the use of sorbents to treat liquid hazardous waste or hazardous waste containing free liquids that will be disposed of directly (e.g., without first being placed in a container) in a landfill. Free liquids in such "bulk or noncontainerized" hazardous wastes must be "chemically, thermally, physically, or biologically treated without the use of absorbents" before the wastes may be landfilled (OSWER Directive #9487.00-2A). To demonstrate that chemical stabilization rather than absorption or adsorption is occurring, the bulk or noncontainerized hazardous waste should undergo an indirect chemical stabilization test (also known as an unconfined compressive strength test). The indirect chemical stabilization test ensures that, prior to direct

disposal, liquid hazardous wastes or hazardous wastes containing  
free liquids wastes have been adequately treated through some  
means other than the addition of sorbents.

RCRA, SUPERFUND & EPCRA CALL CENTER MONTHLY REPORT  
November 2002

**2. Disposal of Wastewaters and the Liquids in Landfills Prohibition**

*A wood preserving facility generates chlorophenolic residuals (F032) containing less than 1 percent by weight total organic carbon (TOC) and less than 1 percent by weight total suspended solids (TSS), which meet the definition of a wastewater under the land disposal restrictions (LDR) program (40 CFR Section 268.2). The facility treats the waste in accordance with the Section 268.40 treatment standards for the F032 wastewater treatability group and places the waste in containers. Can the containerized F032 wastewaters, which have been treated to meet LDR, be placed in a Subtitle C landfill without violating the liquids in landfills prohibition (Sections 264/265.314)?*

Although the waste meets the Section 268.40 LDR treatment standard for the F032 wastewater treatability group, the waste remains subject to the Sections 264/265.314 restrictions applicable to containerized wastes because LDR and the liquids in landfills prohibition are independent and mutually exclusive requirements. The liquid in landfills restriction does not permit the placement of either bulk or containerized liquid hazardous waste or hazardous waste containing free liquids in a landfill. The presence or absence of free liquids in the waste can be determined using SW-846 Method 9095 (Sections 264.314(c) and 265.314(d)). If Method 9095 reveals the presence of free liquids, the containers holding the F032 wastewaters cannot be placed in the landfill until all free-standing liquid: (1) has been removed by decanting or other methods; (2) has been mixed with appropriate sorbents or solidified so that free-standing liquid is no longer observed; or (3) has been otherwise eliminated (Sections 264.314(d) and (e) and 265.314(c) and (f)). Finally, unless the containers are very small (e.g., ampules, vials), they would have to be either 90 percent full, crushed, or similarly reduced in volume to the maximum extent possible prior to placement in a landfill (Sections 264/265.315).

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TITLE 40--PROTECTION OF ENVIRONMENT

CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY (CONTINUED)

PART 260\_HAZARDOUS WASTE MANAGEMENT SYSTEM: GENERAL--Table of Contents

Subpart B\_Definitions

Sec. 260.11 References.

(a) When used in parts 260 through 270 of this chapter, the following publications are incorporated by reference:

(1) ``ASTM Standard Test Methods for Flash Point of Liquids by Setaflash Closed Tester,'' ASTM Standard D-3278-78, available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

(2) ``ASTM Standard Test Methods for Flash Point by Pensky-Martens Closed Tester,'' ASTM Standard D-93-79 or D-93-80. D-93-80 is available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

(3) ``ASTM Standard Method for Analysis of Reformed Gas by Gas Chromatography,'' ASTM Standard D-1946-82, available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

(4) ``ASTM Standard Test Method for Heat of Combustion of Hydrocarbon Fuels by Bomb Calorimeter (High-Precision Method),'' ASTM Standard D 2382-83, available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

(5) ``ASTM Standard Practices for General Techniques of Ultraviolet-Visible Quantitative Analysis,'' ASTM Standard E 169-87 available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

(6) ``ASTM Standard Practices for General Techniques of Infrared Quantitative Analysis,'' ASTM Standard E 168-88, available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

(7) ``ASTM Standard Practice for Packed Column Gas Chromatography,'' ASTM Standard E 260-85, available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

(8) ``ASTM Standard Test Method for Aromatics in Light Naphthas and Aviation Gasolines by Gas Chromatography,'' ASTM Standard D 2267-88, available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

(9) ``APTI Course 415: Control of Gaseous Emissions,'' EPA Publication EPA-450/2-81-005, December 1981, available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

(10) ``Flammable and Combustible Liquids Code'' (1977 or 1981), available from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

(11) ``Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,'' EPA Publication SW-846 [Third Edition (November 1986), as



amended by Updates I (dated July 1992), II (dated September 1994), IIA (dated August 1993), IIB (dated January 1995), III (dated December 1996) and IIA (dated April 1998)]. The Third Edition of SW-846 and Updates I, II, IIA, IIB, and III (document number 955-001-00000-1) are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402, (202) 512-1800. Update IIIA is available through EPA's Methods Information Communication Exchange (MICE) Service. MICE can be contacted by phone at (703) 821-4690. Update IIIA can also be obtained by contacting the U.S. Environmental Protection Agency, Office of Solid Waste (5307W), OSW Methods Team, 1200 Pennsylvania Ave., NW., Washington, DC 20460. Copies of the Third Edition and all of its updates are also available from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161, (703) 605-6000 or (800) 553-6847. Copies may be inspected at the Library, U.S. Environmental Protection Agency, 401 M St., SW., Washington, DC 20460; or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: <http://www.archives.gov/federal--register/code--of--federal--regulations/ibr--locations.html>.

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(12) ``Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised'', October 1992, EPA Publication No. EPA-450/R-92-019, Environmental Protection Agency, Research Triangle Park, NC.

(13) ``ASTM Standard Test Methods for Preparing Refuse-Derived Fuel (RDF) Samples for Analyses of Metals,'' ASTM Standard E926-88, Test Method C--Bomb, Acid Digestion Method, available from American Society for Testing Materials, 1916 Race Street, Philadelphia, PA 19103.

(14) ``API Publication 2517, Third Edition'', February 1989, ``Evaporative Loss from External Floating-Roof Tanks,'' available from the American Petroleum Institute, 1220 L Street, Northwest, Washington, DC 20005.

(15) ``ASTM Standard Test Method for Vapor Pressure--Temperature Relationship and Initial Decomposition Temperature of Liquids by Isoteniscope,'' ASTM Standard D 2879-92, available from American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103.

(16) Method 1664, Revision A, n-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM; Non-polar Material) by Extraction and Gravimetry. Available at NTIS, PB99-121949, U.S. Department of Commerce, 5285 Port Royal, Springfield, Virginia 22161.

(b) The references listed in paragraph (a) of this section are also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: <http://www.archives.gov/federal--register/code--of--federal--regulations/ibr--locations.html>. These incorporations by reference were approved by the Director of the Federal Register. These materials are incorporated as they exist on the date of approval and a notice of any change in these materials will be published in the Federal Register.

[46 FR 35247, July 7, 1981, as amended at 50 FR 18374, Apr. 30, 1985; 52 FR 8073, Mar. 16, 1987; 52 FR 41295, Oct. 27, 1987; 54 FR 40266, Sept. 29, 1989; 55 FR 8949, Mar. 9, 1990; 55 FR 25493, June 21, 1990; 56 FR 72, Feb. 21, 1991; 58 FR 38883, July 20, 1993; 58 FR 46049, Aug. 31, 1993; 59 FR 468, Jan. 4, 1994; 59 FR 28484, June 2, 1994; 59 FR 62926, Dec. 6, 1994; 60 FR 17004, Apr. 4, 1995; 62 FR 32462, June 13, 1997; 64

FR 26327, May 11, 1999; 66 FR 34376, June 28, 2001; 69 FR 19903, Apr. 9, 2004]

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[Page 33-38]

TITLE 40--PROTECTION OF ENVIRONMENT

CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY (CONTINUED)

PART 261\_IDENTIFICATION AND LISTING OF HAZARDOUS WASTE--Table of Contents

Subpart A\_General

Sec. 261.3 Definition of hazardous waste.

(a) A solid waste, as defined in Sec. 261.2, is a hazardous waste if:

(1) It is not excluded from regulation as a hazardous waste under Sec. 261.4(b); and

(2) It meets any of the following criteria:

(i) It exhibits any of the characteristics of hazardous waste identified in subpart C of this part. However, any mixture of a waste from the extraction, beneficiation, and processing of ores and minerals excluded under Sec. 261.4(b)(7) and any other solid waste

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Exhibiting a characteristic of hazardous waste under subpart C is a hazardous waste only if it exhibits a characteristic that would not have been exhibited by the excluded waste alone if such mixture had not occurred, or if it continues to exhibit any of the characteristics exhibited by the non-excluded wastes prior to mixture. Further, for the purposes of applying the Toxicity Characteristic to such mixtures, the mixture is also a hazardous waste if it exceeds the maximum concentration for any contaminant listed in table I to Sec. 261.24 that would not have been exceeded by the excluded waste alone if the mixture had not occurred or if it continues to exceed the maximum concentration for any contaminant exceeded by the nonexempt waste prior to mixture.

(ii) It is listed in subpart D of this part and has not been excluded from the lists in subpart D of this part under Sec. Sec. 260.20 and 260.22 of this chapter.

(iii) [Reserved]

(iv) It is a mixture of solid waste and one or more hazardous wastes listed in subpart D of this part and has not been excluded from paragraph (a)(2) of this section under Sec. Sec. 260.20 and 260.22, paragraph (g) of this section, or paragraph (h) of this section; however, the following mixtures of solid wastes and hazardous wastes listed in subpart D of this part are not hazardous wastes (except by application of paragraph (a)(2)(i) or (ii) of this section) if the generator can demonstrate that the mixture consists of wastewater the discharge of which is subject to regulation under either section 402 or section 307(b) of the Clean Water Act (including wastewater at facilities which have eliminated the discharge of wastewater) and;

(A) One or more of the following solvents listed in Sec. 261.31--carbon tetrachloride, tetrachloroethylene, trichloroethylene--Provided, That the maximum total weekly usage of these solvents (other than the amounts that can be demonstrated not to be discharged to wastewater)

divided by the average weekly flow of wastewater into the headworks of the facility's wastewater treatment or pretreatment system does not exceed 1 part per million; or

(B) One or more of the following spent solvents listed in Sec. 261.31--methylene chloride, 1,1,1-trichloroethane, chlorobenzene, o-dichlorobenzene, cresols, cresylic acid, nitrobenzene, toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, spent chlorofluorocarbon solvents--provided that the maximum total weekly usage of these solvents (other than the amounts that can be demonstrated not to be discharged to wastewater) divided by the average weekly flow of wastewater into the headworks of the facility's wastewater treatment or pretreatment system does not exceed 25 parts per million; or

(C) One of the following wastes listed in Sec. 261.32, provided that the wastes are discharged to the refinery oil recovery sewer before primary oil/water/solids separation--heat exchanger bundle cleaning sludge from the petroleum refining industry (EPA Hazardous Waste No. K050), crude oil storage tank sediment from petroleum refining operations (EPA Hazardous Waste No. K169), clarified slurry oil tank sediment and/or in-line filter/separation solids from petroleum refining operations (EPA Hazardous Waste No. K170), spent hydrotreating catalyst (EPA Hazardous Waste No. K171), and spent hydrorefining catalyst (EPA Hazardous Waste No. K172); or

(D) A discarded commercial chemical product, or chemical intermediate listed in Sec. 261.33, arising from de minimis losses of these materials from manufacturing operations in which these materials are used as raw materials or are produced in the manufacturing process. For purposes of this paragraph (a) (2) (iv) (D), "de minimis" losses include those from normal material handling operations (e.g., spills from the unloading or transfer of materials from bins or other containers; leaks from pipes, valves or other devices used to transfer materials); minor leaks of process equipment, storage tanks or containers; leaks from well maintained pump packings and seals; sample purgings; relief device discharges; discharges from safety showers and rinsing and cleaning of personal safety equipment; and rinsate from empty containers or from containers that are rendered empty by that rinsing; or

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(E) Wastewater resulting from laboratory operations containing toxic (T) wastes listed in subpart D of this part, Provided, That the annualized average flow of laboratory wastewater does not exceed one percent of total wastewater flow into the headworks of the facility's wastewater treatment or pre-treatment system or provided the wastes, combined annualized average concentration does not exceed one part per million in the headworks of the facility's wastewater treatment or pre-treatment facility. Toxic (T) wastes used in laboratories that are demonstrated not to be discharged to wastewater are not to be included in this calculation; or

(F) One or more of the following wastes listed in Sec. 261.32--wastewaters from the production of carbamates and carbamoyl oximes (EPA Hazardous Waste No. K157)--Provided that the maximum weekly usage of formaldehyde, methyl chloride, methylene chloride, and triethylamine (including all amounts that can not be demonstrated to be reacted in the process, destroyed through treatment, or is recovered, i.e., what is discharged or volatilized) divided by the average weekly flow of process wastewater prior to any dilutions into the headworks of the facility's wastewater treatment system does not exceed a total of 5 parts per million by weight; or

(G) Wastewaters derived from the treatment of one or more of the

following wastes listed in Sec. 261.32--organic waste (including heavy ends, still bottoms, light ends, spent solvents, filtrates, and distillates) from the production of carbamates and carbamoyl oximes (EPA Hazardous Waste No. K156).--Provided, that the maximum concentration of formaldehyde, methyl chloride, methylene chloride, and triethylamine prior to any dilutions into the headworks of the facility's wastewater treatment system does not exceed a total of 5 milligrams per liter.

(v) Rebuttable presumption for used oil. Used oil containing more than 1000 ppm total halogens is presumed to be a hazardous waste because it has been mixed with halogenated hazardous waste listed in subpart D of part 261 of this chapter. Persons may rebut this presumption by demonstrating that the used oil does not contain hazardous waste (for example, by using an analytical method from SW-846, Third Edition, to show that the used oil does not contain significant concentrations of halogenated hazardous constituents listed in appendix VIII of part 261 of this chapter). EPA Publication SW-846, Third Edition, is available for the cost of \$110.00 from the Government Printing Office, Superintendent of Documents, PO Box 371954, Pittsburgh, PA 15250-7954. 202-512-1800 (document number 955-001-00000-1).

(A) The rebuttable presumption does not apply to metalworking oils/fluids containing chlorinated paraffins, if they are processed, through a tolling agreement, to reclaim metalworking oils/fluids. The presumption does apply to metalworking oils/fluids if such oils/fluids are recycled in any other manner, or disposed.

(B) The rebuttable presumption does not apply to used oils contaminated with chlorofluorocarbons (CFCs) removed from refrigeration units where the CFCs are destined for reclamation. The rebuttable presumption does apply to used oils contaminated with CFCs that have been mixed with used oil from sources other than refrigeration units.

(b) A solid waste which is not excluded from regulation under paragraph (a)(1) of this section becomes a hazardous waste when any of the following events occur:

(1) In the case of a waste listed in subpart D of this part, when the waste first meets the listing description set forth in subpart D of this part.

(2) In the case of a mixture of solid waste and one or more listed hazardous wastes, when a hazardous waste listed in subpart D is first added to the solid waste.

(3) In the case of any other waste (including a waste mixture), when the waste exhibits any of the characteristics identified in subpart C of this part.

(c) Unless and until it meets the criteria of paragraph (d) of this section:

(1) A hazardous waste will remain a hazardous waste.

(2)(i) Except as otherwise provided in paragraph (c)(2)(ii), (g) or (h) of this section, any solid waste generated from the treatment, storage, or disposal of a

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hazardous waste, including any sludge, spill residue, ash emission control dust, or leachate (but not including precipitation run-off) is a hazardous waste. (However, materials that are reclaimed from solid wastes and that are used beneficially are not solid wastes and hence are not hazardous wastes under this provision unless the reclaimed material is burned for energy recovery or used in a manner constituting disposal.)

(ii) The following solid wastes are not hazardous even though they are generated from the treatment, storage, or disposal of a hazardous waste, unless they exhibit one or more of the characteristics of

hazardous waste:

- (A) Waste pickle liquor sludge generated by lime stabilization of steel pickle liquor from the iron and steel industry (SIC Codes 331 and 332).
- (B) Waste from burning any of the materials exempted from regulation by Sec. 261.6(a)(3)(iii) and (iv).
- (C) (1) Nonwastewater residues, such as slag, resulting from high temperature metals recovery (HTMR) processing of K061, K062 or F006 waste, in units identified as rotary kilns, flame reactors, electric furnaces, plasma arc furnaces, slag reactors, rotary hearth furnace/electric furnace combinations or industrial furnaces (as defined in paragraphs (6), (7), and (13) of the definition for "Industrial furnace" in 40 CFR 260.10), that are disposed in subtitle D units, provided that these residues meet the generic exclusion levels identified in the tables in this paragraph for all constituents, and exhibit no characteristics of hazardous waste. Testing requirements must be incorporated in a facility's waste analysis plan or a generator's self-implementing waste analysis plan; at a minimum, composite samples of residues must be collected and analyzed quarterly and/or when the process or operation generating the waste changes. Persons claiming this exclusion in an enforcement action will have the burden of proving by clear and convincing evidence that the material meets all of the exclusion requirements.

Constituent	Maximum for any single composite sample--TCLP (mg/l)
Generic exclusion levels for K061 and K062 nonwastewater HTMR residues	
Antimony.....	0.10
Arsenic.....	0.50
Barium.....	7.6
Beryllium.....	0.010
Cadmium.....	0.050
Chromium (total).....	0.33
Lead.....	0.15
Mercury.....	0.009
Nickel.....	1.0
Selenium.....	0.16
Silver.....	0.30
Thallium.....	0.020
Zinc.....	70
Generic exclusion levels for F006 nonwastewater HTMR residues	
Antimony.....	0.10
Arsenic.....	0.50
Barium.....	7.6
Beryllium.....	0.010
Cadmium.....	0.050
Chromium (total).....	0.33
Cyanide (total) (mg/kg).....	1.8
Lead.....	0.15
Mercury.....	0.009
Nickel.....	1.0
Selenium.....	0.16

Silver.....	0.30
Thallium.....	0.020
Zn.....	70
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(2) A one-time notification and certification must be placed in the facility's files and sent to the EPA region or authorized state for K061, K062 or F006 HTMR residues that meet the generic exclusion levels for all constituents and do not exhibit any characteristics that are sent to subtitle D units. The notification and certification that is placed in the generators or treaters files must be updated if the process or operation generating the waste changes and/or if the subtitle D unit receiving the waste changes. However, the generator or treater need only notify the EPA region or an authorized state on an annual basis if such changes occur. Such notification and certification should be sent to the EPA region or authorized state by the end of the calendar year, but no later than December 31. The notification must include the following information: The name and address of the subtitle D unit receiving the waste shipments; the EPA Hazardous Waste Number(s) and treatability group(s) at the initial point of generation; and, the treatment

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standards applicable to the waste at the initial point of generation. The certification must be signed by an authorized representative and must state as follows: ``I certify under penalty of law that the generic exclusion levels for all constituents have been met without impermissible dilution and that no characteristic of hazardous waste is exhibited. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.''

- (D) Biological treatment sludge from the treatment of one of the following wastes listed in Sec. 261.32--organic waste (including heavy ends, still bottoms, light ends, spent solvents, filtrates, and decantates) from the production of carbamates and carbamoyl oximes (EPA Hazardous Waste No. K156), and wastewaters from the production of carbamates and carbamoyl oximes (EPA Hazardous Waste No. K157).
- (E) Catalyst inert support media separated from one of the following wastes listed in Sec. 261.32--Spent hydrotreating catalyst (EPA Hazardous Waste No. K171), and Spent hydrorefining catalyst (EPA Hazardous Waste No. K172).

- (d) Any solid waste described in paragraph (c) of this section is not a hazardous waste if it meets the following criteria:
- (1) In the case of any solid waste, it does not exhibit any of the characteristics of hazardous waste identified in subpart C of this part. (However, wastes that exhibit a characteristic at the point of generation may still be subject to the requirements of part 268, even if they no longer exhibit a characteristic at the point of land disposal.)
- (2) In the case of a waste which is a listed waste under subpart D of this part, contains a waste listed under subpart D of this part or is derived from a waste listed in subpart D of this part, it also has been excluded from paragraph (c) of this section under Sec. Sec. 260.20 and 260.22 of this chapter.
- (e) [Reserved]
- (f) Notwithstanding paragraphs (a) through (d) of this section and provided the debris as defined in part 268 of this chapter does not exhibit a characteristic identified at subpart C of this part, the following materials are not subject to regulation under 40 CFR parts 260, 261 to 266, 268, or 270:

(1) Hazardous debris as defined in part 268 of this chapter that has been treated using one of the required extraction or destruction technologies specified in Table 1 of Sec. 268.45 of this chapter; persons claiming this exclusion in an enforcement action will have the burden of proving by clear and convincing evidence that the material meets all of the exclusion requirements; or

(2) Debris as defined in part 268 of this chapter that the Regional Administrator, considering the extent of contamination, has determined is no longer contaminated with hazardous waste.

(g)(1) A hazardous waste that is listed in subpart D of this part solely because it exhibits one or more characteristics of ignitability as defined under Sec. 261.21, corrosivity as defined under Sec. 261.22, or reactivity as defined under Sec. 261.23 is not a hazardous waste, if the waste no longer exhibits any characteristic of hazardous waste identified in subpart C of this part.

(2) The exclusion described in paragraph (g)(1) of this section also pertains to:

(i) Any mixture of a solid waste and a hazardous waste listed in subpart D of this part solely because it exhibits the characteristics of ignitability, corrosivity, or reactivity as regulated under paragraph (a)(2)(iv) of this section; and

(ii) Any solid waste generated from treating, storing, or disposing of a hazardous waste listed in subpart D of this part solely because it exhibits the characteristics of ignitability, corrosivity, or reactivity as regulated under paragraph (c)(2)(i) of this section.

(3) Wastes excluded under this section are subject to part 268 of this chapter (as applicable), even if they no longer exhibit a characteristic at the point of land disposal.

(4) Any mixture of a solid waste excluded from regulation under Sec. 261.4(b)(7) and a hazardous waste listed in subpart D of this part solely because it exhibits one or more of the characteristics of ignitability, corrosivity, or reactivity as regulated

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under paragraph (a)(2)(iv) of this section is not a hazardous waste, if the mixture no longer exhibits any characteristic of hazardous waste identified in subpart C of this part for which the hazardous waste listed in subpart D of this part was listed.

(h)(1) Hazardous waste containing radioactive waste is no longer a hazardous waste when it meets the eligibility criteria and conditions of 40 CFR part 266, Subpart N ('eligible radioactive mixed waste').

(2) The exemption described in paragraph (h)(1) of this section also pertains to:

(i) Any mixture of a solid waste and an eligible radioactive mixed waste; and

(ii) Any solid waste generated from treating, storing, or disposing of an eligible radioactive mixed waste.

(3) Waste exempted under this section must meet the eligibility criteria and specified conditions in 40 CFR 266.225 and 40 CFR 266.230 (for storage and treatment) and in 40 CFR 266.310 and 40 CFR 266.315 (for transportation and disposal). Waste that fails to satisfy these eligibility criteria and conditions is regulated as hazardous waste.

[57 FR 7632, Mar. 3, 1992; 57 FR 23063, June 1, 1992, as amended at 57 FR 37263, Aug. 18, 1992; 57 FR 41611, Sept. 10, 1992; 57 FR 49279, Oct. 30, 1992; 59 FR 38545, July 28, 1994; 60 FR 7848, Feb. 9, 1995; 63 FR 28, May 26, 1998; 63 FR 42184, Aug. 6, 1998; 66 FR 27297, May 16, 2001; 66 FR 50333, Oct. 3, 2001]





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[Page 67-79]

TITLE 40--PROTECTION OF ENVIRONMENT

CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY (CONTINUED)

PART 261\_IDENTIFICATION AND LISTING OF HAZARDOUS WASTE--Table of Contents

Subpart D\_Lists of Hazardous Wastes

Sec. 261.33. Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof.

The following materials or items are hazardous wastes if and when they are discarded or intended to be discarded as described in Sec. 261.2(a)(2)(i), when they are mixed with waste oil or used oil or other material and applied to the land for dust suppression or road treatment, when they are otherwise applied to the land in lieu of their original intended use or when they are contained in products that are applied to the land in lieu of their original intended use, or when, in lieu of their original intended use, they are produced for use as (or as a component of) a fuel, distributed for use as a fuel, or burned as a fuel.

(a) Any commercial chemical product, or manufacturing chemical intermediate having the generic name listed in paragraph (e) or (f) of this section.

(b) Any off-specification commercial chemical product or manufacturing chemical intermediate which, if it met specifications, would have the generic name listed in paragraph (e) or (f) of this section.

(c) Any residue remaining in a container or in an inner liner removed from a container that has held any commercial chemical product or manufacturing chemical intermediate having the generic name listed in paragraphs (e) or (f) of this section, unless the container is empty as defined in Sec. 261.7(b) of this chapter.

[Comment: Unless the residue is being beneficially used or reused, or legitimately recycled or reclaimed; or being accumulated, stored, transported or treated prior to such use, re-use, recycling or reclamation, EPA considers the residue to be intended for discard, and thus, a hazardous waste. An example of a legitimate re-use of the residue would be where the residue remains in the container and the container is used to hold the same commercial chemical product or manufacturing chemical intermediate it previously held. An example of the discard of the residue would be where the drum is sent to a drum reconditioner who reconditions the drum but discards the residue.]

(d) Any residue or contaminated soil, water or other debris resulting from the cleanup of a spill into or on any land or water of any commercial chemical product or manufacturing chemical intermediate having the generic name listed in paragraph (e) or (f) of this section, or any residue or contaminated soil, water or other debris resulting from the cleanup of a spill, into or on any land or water, of any off-specification chemical product and manufacturing chemical intermediate

which, if it met specifications, would have the generic name listed in paragraph (e) or (f) of this section.

[Comment: The phrase "commercial chemical product or manufacturing chemical intermediate having the generic name listed in . . ." refers to a chemical substance which is manufactured or formulated for commercial or manufacturing use which consists of the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient. It does not refer to a material, such as a manufacturing process waste, that contains any of the substances listed in paragraph (e) or (f). Where a manufacturing process waste is deemed to be a hazardous waste because it contains a substance listed in paragraph (e) or (f), such waste will be listed in either Sec. 261.31 or Sec. 261.32 or will be identified as a hazardous waste by the characteristics set forth in subpart C of this part.]

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(e) The commercial chemical products, manufacturing chemical intermediates or off-specification commercial chemical products or manufacturing chemical intermediates referred to in paragraphs (a) through (d) of this section, are identified as acute hazardous wastes (H) and are subject to be the small quantity exclusion defined in Sec. 261.5(e).

[Comment: For the convenience of the regulated community the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), and R (Reactivity). Absence of a letter indicates that the compound only is listed for acute toxicity.]

These wastes and their corresponding EPA Hazardous Waste Numbers are:

Hazardous waste No.	Chemical abstracts No.	Substance
P023	107-20-0	Acetaldehyde, chloro-
P002	591-08-2	Acetamide, N-(aminothioxomethyl)-
P057	640-19-7	Acetamide, 2-fluoro-
P058	62-74-8	Acetic acid, fluoro-, sodium salt
P002	591-08-2	1-Acetyl-2-thiourea
P003	107-02-8	Acrolein
P070	116-06-3	Aldicarb
P203	1646-88-4	Aldicarb sulfone.
P004	309-00-2	Aldrin
P005	107-18-6	Allyl alcohol
P006	20859-73-8	Aluminum phosphide (R,T)
P007	2763-96-4	5-(Aminomethyl)-3-isoxazolol
P008	504-24-5	4-Aminopyridine
P009	131-74-8	Ammonium picrate (R)
P119	7803-55-6	Ammonium vanadate
P009	506-61-6	Argentate(1-), bis(cyano-C)-, potassium
P010	7778-39-4	Arsenic acid H3 AsO4
P012	1327-53-3	Arsenic oxide As2 O3

P011	1303-28-2	Arsenic oxide As <sub>2</sub> O <sub>5</sub>
P011	1303-28-2	Arsenic pentoxide
P0	1327-53-3	Arsenic trioxide
P0	692-42-2	Arsine, diethyl-
P036	696-28-6	Arsonous dichloride, phenyl-
P054	151-56-4	Aziridine
P067	75-55-8	Aziridine, 2-methyl-
P013	542-62-1	Barium cyanide
P024	106-47-8	Benzenamine, 4-chloro-
P077	100-01-6	Benzenamine, 4-nitro-
P028	100-44-7	Benzene, (chloromethyl)-
P042	51-43-4	1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-, (R)-
P046	122-09-8	Benzeneethanamine, alpha,alpha-dimethyl-
P014	108-98-5	Benzenethiol
P127	1563-66-2	7-Benzofuranol, 2,3-dihydro-2,2-dimethyl-, methylcarbamate.
P188	57-64-7	Benzoic acid, 2-hydroxy-, compd. with (3aS-cis)-1,2,3,3a,8,8a-hexahydro-1,3a,8-trimethylpyrrolo[2,3-b]indol-5-yl methylcarbamate ester (1:1).
P001	\1\ 81-81-2	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenylbutyl)-, & salts, when present at concentrations greater than 0.3%
P028	100-44-7	Benzyl chloride
P015	7440-41-7	Beryllium powder
P017	598-31-2	Bromoacetone
P0	357-57-3	Brucine
P0	39196-18-4	2-Butanone, 3,3-dimethyl-1-(methylthio)-, O-[methylamino]carbonyl] oxime
P021	592-01-8	Calcium cyanide
P021	592-01-8	Calcium cyanide Ca(CN) <sub>2</sub>
P189	55285-14-8	Carbamic acid, [(dibutylamino)-thio]methyl-, 2,3-dihydro-2,2-dimethyl- 7-benzofuranyl ester.
P191	644-64-4	Carbamic acid, dimethyl-, 1-[(dimethylamino)carbonyl]- 5-methyl-1H-pyrazol-3-yl ester.
P192	119-38-0	Carbamic acid, dimethyl-, 3-methyl-1-(1-methylethyl)-1H-pyrazol-5-yl ester.
P190	1129-41-5	Carbamic acid, methyl-, 3-methylphenyl ester.
P127	1563-66-2	Carbofuran.
P022	75-15-0	Carbon disulfide
P095	75-44-5	Carbonic dichloride
P189	55285-14-8	Carbosulfan.
P023	107-20-0	Chloroacetaldehyde
P024	106-47-8	p-Chloroaniline
P026	5344-82-1	1-(o-Chlorophenyl)thiourea
P027	542-76-7	3-Chloropropionitrile
P029	544-92-3	Copper cyanide

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P029 544-92-3 Copper cyanide Cu(CN)

P202	64-00-6	m-Cumenyl methylcarbamate.
P030	.....	Cyanides (soluble cyanide salts), not otherwise specified
P030	460-19-5	Cyanogen
P033	506-77-4	Cyanogen chloride
P033	506-77-4	Cyanogen chloride (CN)Cl
P034	131-89-5	2-Cyclohexyl-4,6-dinitrophenol
P016	542-88-1	Dichloromethyl ether
P036	696-28-6	Dichlorophenylarsine
P037	60-57-1	Dieldrin
P038	692-42-2	Diethylarsine
P041	311-45-5	Diethyl-p-nitrophenyl phosphate
P040	297-97-2	O,O-Diethyl O-pyrazinyl phosphorothioate
P043	55-91-4	Diisopropylfluorophosphate (DFP).
P004	309-00-2	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa- chloro- 1,4,4a,5,8,8a,-hexahydro-, (1alpha,4alpha,4abeta,5alpha,8alpha,8abeta) -
P060	465-73-6	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa- chloro- 1,4,4a,5,8,8a-hexahydro-, (1alpha,4alpha,4abeta,5beta,8beta,8abeta) -
P037	60-57-1	2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro- 1a,2,2a,3,6,6a,7,7a-octahydro-, (1aalpha,2beta,2aalpha,3beta,6beta,6alpha,7beta, 7aalpha) -
P051	\1\ 72-20-8	2,7:3,6-Dimethanonaphth [2,3-b]oxirene, 3,4,5,6,9,9-hexachloro- 1a,2,2a,3,6,6a,7,7a-octahydro-, (1aalpha,2beta,2abeta,3alpha,6alpha,6abeta,7beta, 7aalpha) -, & metabolites
P044	60-51-5	Dimethoate
P046	122-09-8	alpha,alpha-Dimethylphenethylamine
P191	644-64-4	Dimetilan.
P047	\1\ 534-52-1	4,6-Dinitro-o-cresol, & salts
P048	51-28-5	2,4-Dinitrophenol
P020	88-85-7	Dinoseb
P085	152-16-9	Diphosphoramidate, octamethyl-
P111	107-49-3	Diphosphoric acid, tetraethyl ester
P039	298-04-4	Disulfoton
P049	541-53-7	Dithiobiuret
P185	26419-73-8	1,3-Dithiolane-2-carboxaldehyde, 2,4-dimethyl-, O- [(methylamino)- carbonyl]oxime.
P050	115-29-7	Endosulfan
P088	145-73-3	Endothall
P051	72-20-8	Endrin
P051	72-20-8	Endrin, & metabolites
P042	51-43-4	Epinephrine
P031	460-19-5	Ethanedinitrile
P185	23135-22-0	Ethanimidothioc acid, 2- (dimethylamino)-N-[[ (methylamino) carbonyl]oxy]-2-oxo-, methyl ester.
P066	16752-77-5	Ethanimidothioic acid,

N-[[ (methylamino) carbonyl] oxy] -,  
methyl ester

P1 107-12-0 Ethyl cyanide  
P0 151-56-4 Ethyleneimine  
P097 52-85-7 Famphur  
P056 7782-41-4 Fluorine  
P057 640-19-7 Fluoroacetamide  
P058 62-74-8 Fluoroacetic acid, sodium salt  
P198 23422-53-9 Formetanate hydrochloride.  
P197 17702-57-7 Formparanate.  
P065 628-86-4 Fulminic acid, mercury(2+) salt (R,T)  
P059 76-44-8 Heptachlor  
P062 757-58-4 Hexaethyl tetraphosphate  
P116 79-19-6 Hydrazinecarbothioamide  
P068 60-34-4 Hydrazine, methyl-  
P063 74-90-8 Hydrocyanic acid  
P063 74-90-8 Hydrogen cyanide  
P096 7803-51-2 Hydrogen phosphide  
P060 465-73-6 Isodrin  
P192 119-38-0 Isolan.  
P202 64-00-6 3-Isopropylphenyl N-methylcarbamate.  
P007 2763-96-4 3(2H)-Isoxazolone, 5-(aminomethyl)-  
P196 15339-36-3 Manganese, /  
bis(dimethylcarbamodithioato-S,S')-,  
P196 15339-36-3 Manganese dimethyldithiocarbamate.  
P092 62-38-4 Mercury, (acetato-O)phenyl-  
P065 628-86-4 Mercury fulminate (R,T)  
P082 62-75-9 Methanamine, N-methyl-N-nitroso-  
P064 624-83-9 Methane, isocyanato-  
P0 542-88-1 Methane, oxybis[chloro-  
P 509-14-8 Methane, tetranitro- (R)

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P118 75-70-7 Methanethiol, trichloro-  
P198 23422-53-9 Methanimidamide, N,N-dimethyl-N'-[3-  
[[ (methylamino) -carbonyl] oxy]phenyl] -  
, monohydrochloride.  
P197 17702-57-7 Methanimidamide, N,N-dimethyl-N'-[2-  
methyl-4-  
[[ (methylamino) carbonyl] oxy]phenyl] -  
P050 115-29-7 6,9-Methano-2,4,3-benzodioxathiepin,  
6,7,8,9,10,10-  
hexachloro-1,5,5a,6,9,9a-hexahydro-,  
3-oxide  
P059 76-44-8 4,7-Methano-1H-indene, 1,4,5,6,7,8,8-  
heptachloro-  
3a,4,7,7a-tetrahydro-  
P199 2032-65-7 Methiocarb.  
P066 16752-77-5 Methomyl  
P068 60-34-4 Methyl hydrazine  
P064 624-83-9 Methyl isocyanate  
P069 75-86-5 2-Methyllactonitrile  
P071 298-00-0 Methyl parathion  
P190 1129-41-5 Metolcarb.  
P1 315-8-4 Mexacarbate.  
P0 86-88-4 alpha-Naphthylthiourea  
P073 13463-39-3 Nickel carbonyl  
P073 13463-39-3 Nickel carbonyl Ni(CO)4, (T-4) -

P074	557-19-7	Nickel cyanide
P074	557-19-7	Nickel cynaide Ni(CN)2
P	\1\ 54-11-5	Nicotine, & salts
P0	10102-43-9	Nitric oxide
P077	100-01-6	p-Nitroaniline
P078	10102-44-0	Nitrogen dioxide
P076	10102-43-9	Nitrogen oxide NO
P078	10102-44-0	Nitrogen oxide NO2
P081	55-63-0	Nitroglycerine (R)
P082	62-75-9	N-Nitrosodimethylamine
P084	4549-40-0	N-Nitrosomethylvinylamine
P085	152-16-9	Octamethylpyrophosphoramide
P087	20816-12-0	Osmium oxide OsO4, (T-4)-
P087	20816-12-0	Osmium tetroxide
P088	145-73-3	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
P194	23135-22-0	Oxamyl.
P089	56-38-2	Parathion
P034	131-89-5	Phenol, 2-cyclohexyl-4,6-dinitro-
P048	51-28-5	Phenol, 2,4-dinitro-
P047	\1\ 534-52-1	Phenol, 2-methyl-4,6-dinitro-, & salts
P020	88-85-7	Phenol, 2-(1-methylpropyl)-4,6-dinitro-
P009	131-74-8	Phenol, 2,4,6-trinitro-, ammonium salt (R)
P128	315-18-4	Phenol, 4-(dimethylamino)-3,5-dimethyl-, methylcarbamate (ester).
P199	2032-65-7	Phenol, (3,5-dimethyl-4-(methylthio)-, methylcarbamate
P	64-00-6	Phenol, 3-(1-methylethyl)-, methyl carbamate.
P201	2631-37-0	Phenol, 3-methyl-5-(1-methylethyl)-, methyl carbamate.
P092	62-38-4	Phenylmercury acetate
P093	103-85-5	Phenylthiourea
P094	298-02-2	Phorate
P095	75-44-5	Phosgene
P096	7803-51-2	Phosphine
P041	311-45-5	Phosphoric acid, diethyl 4-nitrophenyl ester
P039	298-04-4	Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester
P094	298-02-2	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester
P044	60-51-5	Phosphorodithioic acid, O,O-dimethyl S-[2-(methyl amino)-2-oxoethyl] ester
P043	55-91-4	Phosphorofluoridic acid, bis(1-methylethyl) ester
P089	56-38-2	Phosphorothioic acid, O,O-diethyl O-(4-nitrophenyl) ester
P040	297-97-2	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester
P097	52-85-7	Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl] O,O-dimethyl ester
P071	298-00-0	Phosphorothioic acid, O,O,-dimethyl O-(4-nitrophenyl) ester
P2	57-47-6	Physostigmine.
P188	57-64-7	Physostigmine salicylate.
P110	78-00-2	Plumbane, tetraethyl-

P098 151-50-8 Potassium cyanide  
P098 151-50-8 Potassium cyanide K(CN)  
P0 506-61-6 Potassium silver cyanide  
P2 2631-37-0 Promecarb  
P070 116-06-3 Propanal, 2-methyl-2-(methylthio)-,  
O-[(methylamino)carbonyl]oxime  
P203 1646-88-4 Propanal, 2-methyl-2-(methyl-sulfonyl)-,  
O-[(methylamino)carbonyl] oxime.  
P101 107-12-0 Propanenitrile

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P027 542-76-7 Propanenitrile, 3-chloro-  
P069 75-86-5 Propanenitrile, 2-hydroxy-2-methyl-  
P081 55-63-0 1,2,3-Propanetriol, trinitrate (R)  
P017 598-31-2 2-Propanone, 1-bromo-  
P102 107-19-7 Propargyl alcohol  
P003 107-02-8 2-Propenal  
P005 107-18-6 2-Propen-1-ol  
P067 75-55-8 1,2-Propylenimine  
P102 107-19-7 2-Propyn-1-ol  
P008 504-24-5 4-Pyridinamine  
P075 \1\ 54-11-5 Pyridine, 3-(1-methyl-2-pyrrolidinyl)-,  
(S)-, & salts  
P204 57-47-6 Pyrrolo[2,3-b]indol-5-ol,  
1,2,3,3a,8,8a-hexahydro-1,3a,8-  
trimethyl-,  
methylcarbamate (ester), (3aS-cis)-.  
P1 12039-52-0 Selenious acid, dithallium(1+) salt  
P1 630-10-4 Selenourea  
P104 506-64-9 Silver cyanide  
P104 506-64-9 Silver cyanide Ag(CN)  
P105 26628-22-8 Sodium azide  
P106 143-33-9 Sodium cyanide  
P106 143-33-9 Sodium cyanide Na(CN)  
P108 \1\ 57-24-9 Strychnidin-10-one, & salts  
P018 357-57-3 Strychnidin-10-one, 2,3-dimethoxy-  
P108 \1\ 57-24-9 Strychnine, & salts  
P115 7446-18-6 Sulfuric acid, dithallium(1+) salt  
P109 3689-24-5 Tetraethyldithiopyrophosphate  
P110 78-00-2 Tetraethyl lead  
P111 107-49-3 Tetraethyl pyrophosphate  
P112 509-14-8 Tetranitromethane (R)  
P062 757-58-4 Tetrphosphoric acid, hexaethyl ester  
P113 1314-32-5 Thallic oxide  
P113 1314-32-5 Thallium oxide Tl2 O3  
P114 12039-52-0 Thallium(I) selenite  
P115 7446-18-6 Thallium(I) sulfate  
P109 3689-24-5 Thiodiphosphoric acid, tetraethyl  
ester  
P045 39196-18-4 Thiofanox  
P049 541-53-7 Thioimidodicarbonic diamide [(H2  
N)C(S)]2 NH  
P014 108-98-5 Thiophenol  
P116 79-19-6 Thiosemicarbazide  
P0 5344-82-1 Thiourea, (2-chlorophenyl)-  
P0 86-88-4 Thiourea, 1-naphthalenyl-  
P093 103-85-5 Thiourea, phenyl-  
P185 26419-73-8 Tirpate.



P123	8001-35-2	Toxaphene
P118	75-70-7	Trichloromethanethiol
P118	7803-55-6	Vanadic acid, ammonium salt
P118	1314-62-1	Vanadium oxide V2 O5
P120	1314-62-1	Vanadium pentoxide
P084	4549-40-0	Vinylamine, N-methyl-N-nitroso-
P001	\1\ 81-81-2	Warfarin, & salts, when present at concentrations greater than 0.3%
P205	137-30-4	Zinc, bis(dimethylcarbamodithioato-S,S')-,
P121	557-21-1	Zinc cyanide
P121	557-21-1	Zinc cyanide Zn(CN)2
P122	1314-84-7	Zinc phosphide Zn3 P2, when present at concentrations greater than 10% (R,T)
P205	137-30-4	Ziram.

\1\ CAS Number given for parent compound only.

(f) The commercial chemical products, manufacturing chemical intermediates, or off-specification commercial chemical products referred to in paragraphs (a) through (d) of this section, are identified as toxic wastes (T), unless otherwise designated and are subject to the small quantity generator exclusion defined in Sec. 261.5 (a) and (g).

[Comment: For the convenience of the regulated community, the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), R (Reactivity), I (Ignitability) and C (Corrosivity). Absence of a letter indicates that the compound is only listed for toxicity.]

These wastes and their corresponding EPA Hazardous Waste Numbers are:

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Hazardous waste No.	Chemical abstracts No.	Substance
U394	30558-43-1	A2213.
U001	75-07-0	Acetaldehyde (I)
U034	75-87-6	Acetaldehyde, trichloro-
U187	62-44-2	Acetamide, N-(4-ethoxyphenyl)-
U005	53-96-3	Acetamide, N-9H-fluoren-2-yl-
U240	\1\ 94-75-7	Acetic acid, (2,4-dichlorophenoxy)-, salts & esters
U112	141-78-6	Acetic acid ethyl ester (I)
U144	301-04-2	Acetic acid, lead(2+) salt
U214	563-68-8	Acetic acid, thallium(1+) salt
see F027	93-76-5	Acetic acid, (2,4,5-trichlorophenoxy)-
U002	67-64-1	Acetone (I)
U003	75-05-8	Acetonitrile (I,T)
U004	98-86-2	Acetophenone
U005	53-96-3	2-Acetylaminofluorene
U006	75-36-5	Acetyl chloride (C,R,T)
U007	79-06-1	Acrylamide
U008	79-10-7	Acrylic acid (I)

U009	107-13-1	Acrylonitrile
U011	61-82-5	Amitrole
U012	62-53-3	Aniline (I,T)
U013	75-60-5	Arsinic acid, dimethyl-
U014	492-80-8	Auramine
U015	115-02-6	Azaserine
U010	50-07-7	Azirino[2',3':3,4]pyrrolo[1,2-a]indole-4,7-dione, 6-amino-8-[[ (aminocarbonyl)oxy)methyl]-1,1a,2,8,8a,8b-hexahydro-8a-methoxy-5-methyl-, [1aS-(1aalpha,8beta,8aalpha,8balpha)]-
U280	101-27-9	Barban.
U278	22781-23-3	Bendiocarb.
U364	22961-82-6	Bendiocarb phenol.
U271	17804-35-2	Benomyl.
U157	56-49-5	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-
U016	225-51-4	Benz[c]acridine
U017	98-87-3	Benzal chloride
U192	23950-58-5	Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl)-
U018	56-55-3	Benz[a]anthracene
U094	57-97-6	Benz[a]anthracene, 7,12-dimethyl-
U012	62-53-3	Benzenamine (I,T)
U014	492-80-8	Benzenamine, 4,4'-carbonimidoylbis[N,N-dimethyl-
U049	3165-93-3	Benzenamine, 4-chloro-2-methyl-, hydrochloride
U010	60-11-7	Benzenamine, N,N-dimethyl-4-(phenylazo)-
U328	95-53-4	Benzenamine, 2-methyl-
U353	106-49-0	Benzenamine, 4-methyl-
U158	101-14-4	Benzenamine, 4,4'-methylenebis[2-chloro-
U222	636-21-5	Benzenamine, 2-methyl-, hydrochloride
U181	99-55-8	Benzenamine, 2-methyl-5-nitro-
U019	71-43-2	Benzene (I,T)
U038	510-15-6	Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-, ethyl ester
U030	101-55-3	Benzene, 1-bromo-4-phenoxy-
U035	305-03-3	Benzenebutanoic acid, 4-[bis(2-chloroethyl)amino]-
U037	108-90-7	Benzene, chloro-
U221	25376-45-8	Benzenediamine, ar-methyl-
U028	117-81-7	1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester
U069	84-74-2	1,2-Benzenedicarboxylic acid, dibutyl ester
U088	84-66-2	1,2-Benzenedicarboxylic acid, diethyl ester
U102	131-11-3	1,2-Benzenedicarboxylic acid, dimethyl ester
U107	117-84-0	1,2-Benzenedicarboxylic acid, dioctyl ester
U010	95-50-1	Benzene, 1,2-dichloro-
U011	541-73-1	Benzene, 1,3-dichloro-
U072	106-46-7	Benzene, 1,4-dichloro-
U060	72-54-8	Benzene, 1,1'-(2,2-

		dichloroethylidene)bis[4-chloro-
U017	98-87-3	Benzene, (dichloromethyl)-
U	26471-62-5	Benzene, 1,3-diisocyanatomethyl- (R,T)
U2	1330-20-7	Benzene, dimethyl- (I,T)
U201	108-46-3	1,3-Benzenediol
U127	118-74-1	Benzene, hexachloro-
U056	110-82-7	Benzene, hexahydro- (I)
U220	108-88-3	Benzene, methyl-
U105	121-14-2	Benzene, 1-methyl-2,4-dinitro-
U106	606-20-2	Benzene, 2-methyl-1,3-dinitro-
U055	98-82-8	Benzene, (1-methylethyl)- (I)
U169	98-95-3	Benzene, nitro-
U183	608-93-5	Benzene, pentachloro-

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U185	82-68-8	Benzene, pentachloronitro-
U020	98-09-9	Benzenesulfonic acid chloride (C,R)
U020	98-09-9	Benzenesulfonyl chloride (C,R)
U207	95-94-3	Benzene, 1,2,4,5-tetrachloro-
U061	50-29-3	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4-chloro-
U247	72-43-5	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4-methoxy-
U023	98-07-7	Benzene, (trichloromethyl)-
U234	99-35-4	Benzene, 1,3,5-trinitro-
U021	92-87-5	Benzidine
U202	\1\ 81-07-2	1,2-Benzisothiazol-3(2H)-one, 1,1-dioxide, & salts
U2	22781-23-3	1,3-Benzodioxol-4-ol, 2,2-dimethyl-, methyl carbamate.
U364	22961-82-6	1,3-Benzodioxol-4-ol, 2,2-dimethyl-,
U203	94-59-7	1,3-Benzodioxole, 5-(2-propenyl)-
U141	120-58-1	1,3-Benzodioxole, 5-(1-propenyl)-
U367	1563-38-8	7-Benzofuranol, 2,3-dihydro-2,2-dimethyl-
U090	94-58-6	1,3-Benzodioxole, 5-propyl-
U064	189-55-9	Benzo[rst]pentaphene
U248	\1\81-81-2	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenyl-butyl)-, & salts, when present at concentrations of 0.3% or less
U022	50-32-8	Benzo[a]pyrene
U197	106-51-4	p-Benzoquinone
U023	98-07-7	Benzotrichloride (C,R,T)
U085	1464-53-5	2,2'-Bioxirane
U021	92-87-5	[1,1'-Biphenyl]-4,4'-diamine
U073	91-94-1	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-
U091	119-90-4	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethoxy-
U095	119-93-7	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-
U225	75-25-2	Bromoform
U030	101-55-3	4-Bromophenyl phenyl ether
U1	87-68-3	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-
U1	924-16-3	1-Butanamine, N-butyl-N-nitroso-
U031	71-36-3	1-Butanol (I)
U159	78-93-3	2-Butanone (I,T)

U160	1338-23-4	2-Butanone, peroxide (R,T)
U053	4170-30-3	2-Butenal
U	764-41-0	2-Butene, 1,4-dichloro- (I,T)
U1	303-34-4	2-Butenoic acid, 2-methyl-, 7-[[2,3-dihydroxy-2-(1-methoxyethyl)-3-methyl-1-oxobutoxy]methyl]-2,3,5,7a-tetrahydro-1H-pyrrolizin-1-yl ester, [1S-[1alpha(Z),7(2S*,3R*),7aalpha]]-
U031	71-36-3	n-Butyl alcohol (I)
U136	75-60-5	Cacodylic acid
U032	13765-19-0	Calcium chromate
U372	10605-21-7	Carbamic acid, 1H-benzimidazol-2-yl, methyl ester.
U271	17804-35-2	Carbamic acid, [1-[(butylamino)carbonyl]-1H-benzimidazol-2-yl]-, methyl ester.
U280	101-27-9	Carbamic acid, (3-chlorophenyl)-, 4-chloro-2-butynyl ester.
U238	51-79-6	Carbamic acid, ethyl ester
U178	615-53-2	Carbamic acid, methylnitroso-, ethyl ester
U373	122-42-9	Carbamic acid, phenyl-, 1-methylethyl ester.
U409	23564-05-8	Carbamic acid, [1,2-phenylenebis(iminocarbonothioyl)]bis-, dimethyl ester.
U097	79-44-7	Carbamic chloride, dimethyl-
U	2303-17-5	Carbamothioic acid, bis(1-methylethyl)-, S-(2,3,3-trichloro-2-propenyl) ester.
U387	52888-80-9	Carbamothioic acid, dipropyl-, S-(phenylmethyl) ester.
U114	\1\ 111-54-6	Carbamodithioic acid, 1,2-ethanediylbis-, salts & esters
U062	2303-16-4	Carbamothioic acid, bis(1-methylethyl)-, S-(2,3-di chloro-2-propenyl) ester
U279	63-25-2	Carbaryl.
U372	10605-21-7	Carbendazim.
U367	1563-38-8	Carbofuran phenol.
U215	6533-73-9	Carbonic acid, dithallium(1+) salt
U033	353-50-4	Carbonic difluoride
U156	79-22-1	Carbonochloridic acid, methyl ester (I,T)
U033	353-50-4	Carbon oxyfluoride (R,T)
U211	56-23-5	Carbon tetrachloride
U034	75-87-6	Chloral
U035	305-03-3	Chlorambucil
U036	57-74-9	Chlordane, alpha & gamma isomers
U026	494-03-1	Chlornaphazin
U037	108-90-7	Chlorobenzene
U038	510-15-6	Chlorobenzilate
U039	59-50-7	p-Chloro-m-cresol
U042	110-75-8	2-Chloroethyl vinyl ether

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U044	67-66-3	Chloroform
U046	107-30-2	Chloromethyl methyl ether
U047	91-58-7	beta-Chloronaphthalene
U048	95-57-8	o-Chlorophenol
U049	3165-93-3	4-Chloro-o-toluidine, hydrochloride
U032	13765-19-0	Chromic acid H2 CrO4, calcium salt
U050	218-01-9	Chrysene
U051	.....	Creosote
U052	1319-77-3	Cresol (Cresylic acid)
U053	4170-30-3	Crotonaldehyde
U055	98-82-8	Cumene (I)
U246	506-68-3	Cyanogen bromide (CN)Br
U197	106-51-4	2,5-Cyclohexadiene-1,4-dione
U056	110-82-7	Cyclohexane (I)
U129	58-89-9	Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1alpha,2alpha,3beta,4alpha,5alpha,6b eta) -
U057	108-94-1	Cyclohexanone (I)
U130	77-47-4	1,3-Cyclopentadiene, 1,2,3,4,5,5- hexachloro-
U058	50-18-0	Cyclophosphamide
U240	\1\ 94-75-7	2,4-D, salts & esters
U059	20830-81-3	Daunomycin
U060	72-54-8	DDD
U061	50-29-3	DDT
U062	2303-16-4	Diallate
U063	53-70-3	Dibenz[a,h]anthracene
U064	189-55-9	Dibenzo[a,i]pyrene
U066	96-12-8	1,2-Dibromo-3-chloropropane
U067	84-74-2	Dibutyl phthalate
U068	95-50-1	o-Dichlorobenzene
U071	541-73-1	m-Dichlorobenzene
U072	106-46-7	p-Dichlorobenzene
U073	91-94-1	3,3'-Dichlorobenzidine
U074	764-41-0	1,4-Dichloro-2-butene (I,T)
U075	75-71-8	Dichlorodifluoromethane
U078	75-35-4	1,1-Dichloroethylene
U079	156-60-5	1,2-Dichloroethylene
U025	111-44-4	Dichloroethyl ether
U027	108-60-1	Dichloroisopropyl ether
U024	111-91-1	Dichloromethoxy ethane
U081	120-83-2	2,4-Dichlorophenol
U082	87-65-0	2,6-Dichlorophenol
U084	542-75-6	1,3-Dichloropropene
U085	1464-53-5	1,2:3,4-Diepoxybutane (I,T)
U108	123-91-1	1,4-Diethyleneoxide
U028	117-81-7	Diethylhexyl phthalate
U395	5952-26-1	Diethylene glycol, dicarbamate.
U086	1615-80-1	N,N'-Diethylhydrazine
U087	3288-58-2	O,O-Diethyl S-methyl dithiophosphate
U088	84-66-2	Diethyl phthalate
U089	56-53-1	Diethylstilbesterol
U090	94-58-6	Dihydrosafrole
U091	119-90-4	3,3'-Dimethoxybenzidine
U092	124-40-3	Dimethylamine (I)
U093	60-11-7	p-Dimethylaminoazobenzene
U094	57-97-6	7,12-Dimethylbenz[a]anthracene
U095	119-93-7	3,3'-Dimethylbenzidine
U096	80-15-9	alpha,alpha- Dimethylbenzylhydroperoxide (R)

U097	79-44-7	Dimethylcarbamoyl chloride
U098	57-14-7	1,1-Dimethylhydrazine
U099	540-73-8	1,2-Dimethylhydrazine
U100	105-67-9	2,4-Dimethylphenol
U102	131-11-3	Dimethyl phthalate
U103	77-78-1	Dimethyl sulfate
U105	121-14-2	2,4-Dinitrotoluene
U106	606-20-2	2,6-Dinitrotoluene
U107	117-84-0	Di-n-octyl phthalate
U108	123-91-1	1,4-Dioxane
U109	122-66-7	1,2-Diphenylhydrazine
U110	142-84-7	Dipropylamine (I)
U111	621-64-7	Di-n-propylnitrosamine
U041	106-89-8	Epichlorohydrin
U001	75-07-0	Ethanal (I)
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U404	121-44-8	Ethanamine, N,N-diethyl-
U174	55-18-5	Ethanamine, N-ethyl-N-nitroso-
U155	91-80-5	1,2-Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)-
U067	106-93-4	Ethane, 1,2-dibromo-
U076	75-34-3	Ethane, 1,1-dichloro-
U077	107-06-2	Ethane, 1,2-dichloro-
U131	67-72-1	Ethane, hexachloro-
U024	111-91-1	Ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro-
U183	60-29-7	Ethane, 1,1'-oxybis-(I)
U001	111-44-4	Ethane, 1,1'-oxybis[2-chloro-
U184	76-01-7	Ethane, pentachloro-
U208	630-20-6	Ethane, 1,1,1,2-tetrachloro-
U209	79-34-5	Ethane, 1,1,2,2-tetrachloro-
U218	62-55-5	Ethanethioamide
U226	71-55-6	Ethane, 1,1,1-trichloro-
U227	79-00-5	Ethane, 1,1,2-trichloro-
U410	59669-26-0	Ethanimidothioic acid, N,N'-[thiobis[(methylimino)carbonyloxy]]bis-, dimethyl ester
U394	30558-43-1	Ethanimidothioic acid, 2-(dimethylamino)-N-hydroxy-2-oxo-, methyl ester.
U359	110-80-5	Ethanol, 2-ethoxy-
U173	1116-54-7	Ethanol, 2,2'-(nitrosoimino)bis-
U395	5952-26-1	Ethanol, 2,2'-oxybis-, dicarbamate.
U004	98-86-2	Ethanone, 1-phenyl-
U043	75-01-4	Ethene, chloro-
U042	110-75-8	Ethene, (2-chloroethoxy)-
U078	75-35-4	Ethene, 1,1-dichloro-
U079	156-60-5	Ethene, 1,2-dichloro-, (E)-
U210	127-18-4	Ethene, tetrachloro-
U228	79-01-6	Ethene, trichloro-
U112	141-78-6	Ethyl acetate (I)
U113	140-88-5	Ethyl acrylate (I)
U238	51-79-6	Ethyl carbamate (urethane)
U183	60-29-7	Ethyl ether (I)
U183	\1\ 111-54-6	Ethylenebisdithiocarbamic acid, salts & esters
U067	106-93-4	Ethylene dibromide

U077 107-06-2 Ethylene dichloride  
U359 110-80-5 Ethylene glycol monoethyl ether  
U 75-21-8 Ethylene oxide (I,T)  
U 96-45-7 Ethylenethiourea  
U076 75-34-3 Ethylidene dichloride  
U118 97-63-2 Ethyl methacrylate  
U119 62-50-0 Ethyl methanesulfonate  
U120 206-44-0 Fluoranthene  
U122 50-00-0 Formaldehyde  
U123 64-18-6 Formic acid (C,T)  
U124 110-00-9 Furan (I)  
U125 98-01-1 2-Furancarboxaldehyde (I)  
U147 108-31-6 2,5-Furandione  
U213 109-99-9 Furan, tétrahydro-(I)  
U125 98-01-1 Furfural (I)  
U124 110-00-9 Furfuran (I)  
U206 18883-66-4 Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-, D-  
U206 18883-66-4 D-Glucose, 2-deoxy-2-  
[[ (methylnitrosoamino) -  
carbonyl] amino] -  
U126 765-34-4 Glycidylaldehyde  
U163 70-25-7 Guanidine, N-methyl-N'-nitro-N-nitroso-  
  
U127 118-74-1 Hexachlorobenzene  
U128 87-68-3 Hexachlorobutadiene  
U130 77-47-4 Hexachlorocyclopentadiene  
U131 67-72-1 Hexachloroethane  
U132 70-30-4 Hexachlorophene  
U 1888-71-7 Hexachloropropene  
U 302-01-2 Hydrazine (R,T)  
U086 1615-80-1 Hydrazine, 1,2-diethyl-  
U098 57-14-7 Hydrazine, 1,1-dimethyl-  
U099 540-73-8 Hydrazine, 1,2-dimethyl-  
U109 122-66-7 Hydrazine, 1,2-diphenyl-  
U134 7664-39-3 Hydrofluoric acid (C,T)  
U134 7664-39-3 Hydrogen fluoride (C,T)  
U135 7783-06-4 Hydrogen sulfide  
U135 7783-06-4 Hydrogen sulfide H2 S  
U096 80-15-9 Hydroperoxide, 1-methyl-1-phenylethyl-  
(R)  
U116 96-45-7 2-Imidazolidinethione

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U137 193-39-5 Indeno[1,2,3-cd]pyrene  
U190 85-44-9 1,3-Isobenzofurandione  
U140 78-83-1 Isobutyl alcohol (I,T)  
U141 120-58-1 Isosafrole  
U142 143-50-0 Kepone  
U143 303-34-4 Lasiocarpine  
U144 301-04-2 Lead acetate  
U146 1335-32-6 Lead, bis(acetato-O) tetrahydroxytri-  
U145 7446-27-7 Lead phosphate  
U146 1335-32-6 Lead subacetate  
U 58-89-9 Lindane  
U 70-25-7 MNNG  
U147 108-31-6 Maleic anhydride  
U148 123-33-1 Maleic hydrazide

U149	109-77-3	Malononitrile
U150	148-82-3	Melphalan
U	7439-97-6	Mercury
U	126-98-7	Methacrylonitrile (I, T)
U092	124-40-3	Methanamine, N-methyl- (I)
U029	74-83-9	Methane, bromo-
U045	74-87-3	Methane, chloro- (I, T)
U046	107-30-2	Methane, chloromethoxy-
U068	74-95-3	Methane, dibromo-
U080	75-09-2	Methane, dichloro-
U075	75-71-8	Methane, dichlorodifluoro-
U138	74-88-4	Methane, iodo-
U119	62-50-0	Methanesulfonic acid, ethyl ester
U211	56-23-5	Methane, tetrachloro-
U153	74-93-1	Methanethiol (I, T)
U225	75-25-2	Methane, tribromo-
U044	67-66-3	Methane, trichloro-
U121	75-69-4	Methane, trichlorofluoro-
U036	57-74-9	4,7-Methano-1H-indene, 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-
U154	67-56-1	Methanol (I)
U155	91-80-5	Methapyrilene
U142	143-50-0	1,3,4-Metheno-2H-cyclobuta[cd]pentalen-2-one, 1,1a,3,3a,4,5,5,5a,5b,6-decachlorooctahydro-
U247	72-43-5	Methoxychlor
U154	67-56-1	Methyl alcohol (I)
U029	74-83-9	Methyl bromide
U186	504-60-9	1-Methylbutadiene (I)
U	74-87-3	Methyl chloride (I,T)
U	79-22-1	Methyl chlorocarbonate (I,T)
U226	71-55-6	Methyl chloroform
U157	56-49-5	3-Methylcholanthrene
U158	101-14-4	4,4'-Methylenebis(2-chloroaniline)
U068	74-95-3	Methylene bromide
U080	75-09-2	Methylene chloride
U159	78-93-3	Methyl ethyl ketone (MEK) (I,T)
U160	1338-23-4	Methyl ethyl ketone peroxide (R,T)
U138	74-88-4	Methyl iodide
U161	108-10-1	Methyl isobutyl ketone (I)
U162	80-62-6	Methyl methacrylate (I,T)
U161	108-10-1	4-Methyl-2-pentanone (I)
U164	56-04-2	Methylthiouracil
U010	50-07-7	Mitomycin C
U059	20830-81-3	5,12-Naphthacenedione, 8-acetyl-10-[(3-amino-2,3,6-trideoxy)-alpha-L-lyxohexopyranosyl]oxy]-7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-, (8S-cis)-
U167	134-32-7	1-Naphthalenamine
U168	91-59-8	2-Naphthalenamine
U026	494-03-1	Naphthalenamine, N,N'-bis(2-chloroethyl)-
U165	91-20-3	Naphthalene
U047	91-58-7	Naphthalene, 2-chloro-
U166	130-15-4	1,4-Naphthalenedione
U2	72-57-1	2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'-dimethyl[1,1'-biphenyl]-4,4'-diyl)bis(azo)bis[5-amino-4-hydroxy]-,



		tetrasodium salt
U279	63-25-2	1-Naphthalenol, methylcarbamate.
U1	130-15-4	1,4-Naphthoquinone
U1	134-32-7	alpha-Naphthylamine
U168	91-59-8	beta-Naphthylamine
U217	10102-45-1	Nitric acid, thallium(1+) salt
U169	98-95-3	Nitrobenzene (I,T)
U170	100-02-7	p-Nitrophenol

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U171	79-46-9	2-Nitropropane (I,T)
U172	924-16-3	N-Nitrosodi-n-butylamine
U173	1116-54-7	N-Nitrosodiethanolamine
U174	55-18-5	N-Nitrosodiethylamine
U176	759-73-9	N-Nitroso-N-ethylurea
U177	684-93-5	N-Nitroso-N-methylurea
U178	615-53-2	N-Nitroso-N-methylurethane
U179	100-75-4	N-Nitrosopiperidine
U180	930-55-2	N-Nitrosopyrrolidine
U181	99-55-8	5-Nitro-o-toluidine
U193	1120-71-4	1,2-Oxathiolane, 2,2-dioxide
U058	50-18-0	2H-1,3,2-Oxazaphosphorin-2-amine, N,N-bis(2-chloroethyl)tetrahydro-, 2- oxide
U115	75-21-8	Oxirane (I,T)
U126	765-34-4	Oxiranecarboxyaldehyde
U041	106-89-8	Oxirane, (chloromethyl)-
U1	123-63-7	Paraldehyde
U184	608-93-5	Pentachlorobenzene
U185	76-01-7	Pentachloroethane
See F027	82-68-8	Pentachloronitrobenzene (PCNB)
U161	87-86-5	Pentachlorophenol
U186	108-10-1	Pentanol, 4-methyl-
U187	504-60-9	1,3-Pentadiene (I)
U188	62-44-2	Phenacetin
U048	108-95-2	Phenol
U039	95-57-8	Phenol, 2-chloro-
U081	59-50-7	Phenol, 4-chloro-3-methyl-
U082	120-83-2	Phenol, 2,4-dichloro-
U089	87-65-0	Phenol, 2,6-dichloro-
U101	56-53-1	Phenol, 4,4'-(1,2-diethyl-1,2- ethenediyl)bis-, (E)-
U052	105-67-9	Phenol, 2,4-dimethyl-
U132	1319-77-3	Phenol, methyl-
U411	70-30-4	Phenol, 2,2'-methylenebis[3,4,6- trichloro-
U170	114-26-1	Phenol, 2-(1-methylethoxy)-, methylcarbamate.
See F027	100-02-7	Phenol, 4-nitro-
See F027	87-86-5	Phenol, pentachloro-
See F027	58-90-2	Phenol, 2,3,4,6-tetrachloro-
See F027	95-95-4	Phenol, 2,4,5-trichloro-
U150	88-06-2	Phenol, 2,4,6-trichloro-
U1	148-82-3	L-Phenylalanine, 4-[bis(2- chloroethyl)amino]-
U087	7446-27-7	Phosphoric acid, lead(2+) salt (2:3)
	3288-58-2	Phosphorodithioic acid, O,O-diethyl S- methyl ester

U189	1314-80-3	Phosphorus sulfide (R)
U190	85-44-9	Phthalic anhydride
U191	109-06-8	2-Picoline
U192	100-75-4	Piperidine, 1-nitroso-
U194	23950-58-5	Pronamide
U111	107-10-8	1-Propanamine (I,T)
U110	621-64-7	1-Propanamine, N-nitroso-N-propyl-
U066	142-84-7	1-Propanamine, N-propyl- (I)
U083	96-12-8	Propane, 1,2-dibromo-3-chloro-
U149	78-87-5	Propane, 1,2-dichloro-
U171	109-77-3	Propanedinitrile
U027	79-46-9	Propane, 2-nitro- (I,T)
U193	108-60-1	Propane, 2,2'-oxybis[2-chloro-
See F027	1120-71-4	1,3-Propane sultone
	93-72-1	Propanoic acid, 2-(2,4,5-trichlorophenoxy)-
U235	126-72-7	1-Propanol, 2,3-dibromo-, phosphate (3:1)
U140	78-83-1	1-Propanol, 2-methyl- (I,T)
U002	67-64-1	2-Propanone (I)
U007	79-06-1	2-Propenamide
U084	542-75-6	1-Propene, 1,3-dichloro-
U243	1888-71-7	1-Propene, 1,1,2,3,3,3-hexachloro-
U009	107-13-1	2-Propenenitrile
U152	126-98-7	2-Propenenitrile, 2-methyl- (I,T)
U008	79-10-7	2-Propenoic acid (I)

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U118	140-88-5	2-Propenoic acid, ethyl ester (I)
	97-63-2	2-Propenoic acid, 2-methyl-, ethyl ester
U162	80-62-6	2-Propenoic acid, 2-methyl-, methyl ester (I,T)
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U411	114-26-1	Propoxur.
U387	52888-80-9	Prosulfocarb.
U194	107-10-8	n-Propylamine (I,T)
U083	78-87-5	Propylene dichloride
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U191	109-06-8	Pyridine, 2-methyl-
U237	66-75-1	2,4-(1H,3H)-Pyrimidinedione, 5-[bis(2-chloroethyl)amino]-
U164	56-04-2	4(1H)-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-
U180	930-55-2	Pyrrolidine, 1-nitroso-
U200	50-55-5	Reserpine
U201	108-46-3	Resorcinol
U202	\1\ 81-07-2	Saccharin, & salts
U203	94-59-7	Safrole
U204	7783-00-8	Selenious acid
U204	7783-00-8	Selenium dioxide
U205	7488-56-4	Selenium sulfide
U205	7488-56-4	Selenium sulfide SeS2 (R,T)
U001	115-02-6	L-Serine, diazoacetate (ester)
See F027	93-72-1	Silvex (2,4,5-TP)
U206	18883-66-4	Streptozotocin
U103	77-78-1	Sulfuric acid, dimethyl ester

U189	1314-80-3	Sulfur phosphide (R)
See F027	93-76-5	2,4,5-T
U2	95-94-3	1,2,4,5-Tetrachlorobenzene
U2	630-20-6	1,1,1,2-Tetrachloroethane
U209	79-34-5	1,1,2,2-Tetrachloroethane
U210	127-18-4	Tetrachloroethylene
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U214	563-68-8	Thallium(I) acetate
U215	6533-73-9	Thallium(I) carbonate
U216	7791-12-0	Thallium(I) chloride
U216	7791-12-0	Thallium chloride Tlcl
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U244	137-26-8	Thioperoxydicarbonic diamide [(H2 N)C(S)]2 S2, tetramethyl-
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U221	25376-45-8	Toluenediamine
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U2	79-01-6	Trichloroethylene
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U248	\1\ 81-81-2	Warfarin, & salts, when present at concentrations of 0.3% or less
U239	1330-20-7	Xylene (I)
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U24	1314-84-7	Zinc phosphide Zn3 P2, when present at concentrations of 10% or less

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\1\ CAS Number given for parent compound only.

[REDACTED] R 78529, 78541, Nov. 25, 1980]

Editorial Note: For Federal Register citations affecting Sec. 261.33, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and on GPO Access.

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[Page 214-220]

## TITLE 40--PROTECTION OF ENVIRONMENT

## CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY (CONTINUED)

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Appendix IX to Part 264--Ground-Water Monitoring List

Authority: 42 U.S.C. 6905, 6912(a), 6924, 6925, 6927, 6928(h), and 6974.

Source: 45 FR 33221, May 19, 1980, unless otherwise noted.

(a) The purpose of this part is to establish minimum national standards which define the acceptable management of hazardous waste.  
(b) The standards in this part apply to owners and operators of all facilities which treat, store, or dispose of hazardous waste, except as specifically provided otherwise in this part or part 261 of this chapter.

(c) The requirements of this part apply to a person disposing of hazardous waste by means of ocean disposal subject to a permit issued under the Marine Protection, Research, and Sanctuaries Act only to the extent they are included in a RCRA permit by rule granted to such a person under part 270 of this chapter.

[Comment: These part 264 regulations do apply to the treatment or storage of hazardous waste before it is loaded onto an ocean vessel for incineration or disposal at sea.]

(d) The requirements of this part apply to a person disposing of hazardous waste by means of underground injection subject to a permit issued under an Underground Injection Control (UIC) program approved or promulgated under the Safe Drinking Water Act only to the extent they are required by Sec. 144.14 of this chapter.

[Comment: These part 264 regulations do apply to the above-ground treatment or storage of hazardous waste before it is injected underground.]

(e) The requirements of this part apply to the owner or operator of a POTW which treats, stores, or disposes of hazardous waste only to the extent they are included in a RCRA permit by rule granted to such a person under part 270 of this chapter.

(f) The requirements of this part do not apply to a person who treats, stores, or disposes of hazardous waste in a State with a RCRA hazardous waste program authorized under subpart A of part 271 of this chapter, or in a State authorized under subpart B of part 271 of this chapter for the component or components of Phase II interim authorization which correspond to the person's treatment, storage or disposal processes; except that this part will apply:

(1) As stated in paragraph (d) of this section, if the authorized State RCRA program does not cover disposal of hazardous waste by means of underground injection; and

(2) To a person who treats, stores or disposes of hazardous waste in a State authorized under subpart A of part 271 of this chapter, at a facility which was not covered by standards under this part when the State obtained authorization, and for which EPA promulgates standards under this part after the State is authorized. This paragraph will only apply until the State is authorized to permit such facilities under subpart A of part 271 of this chapter.

(3) To a person who treats, stores, or disposes of hazardous waste in a State which is authorized under subpart A or B of part 271 of this chapter if the State has not been authorized to carry out the requirements and prohibitions applicable to the treatment, storage, or disposal of hazardous waste at his facility which are imposed pursuant to the Hazardous and Solid Waste Amendments of 1984. The requirements and prohibitions that are applicable until a State receives authorization to carry them out include all Federal program requirements identified in Sec. 271.1(j).

(g) The requirements of this part do not apply to:

(1) The owner or operator of a facility permitted, licensed, or registered by a State to manage municipal or industrial solid waste, if the only hazardous

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wa the facility treats, stores, or disposes of is excluded from regulation under this part by Sec. 261.5 of this chapter;

(2) The owner or operator of a facility managing recyclable

materials described in Sec. 261.6 (a)(2), (3), and (4) of this chapter (except to the extent they are referred to in part 279 or subparts C, D, F, and G of part 266 of this chapter).

(3) A generator accumulating waste on-site in compliance with Sec. 262.34 of this chapter;

(4) A farmer disposing of waste pesticides from his own use in compliance with Sec. 262.70 of this chapter; or

(5) The owner or operator of a totally enclosed treatment facility, as defined in Sec. 260.10.

(6) The owner or operator of an elementary neutralization unit or a wastewater treatment unit as defined in Sec. 260.10 of this chapter, provided that if the owner or operator is diluting hazardous ignitable (D001) wastes (other than the D001 High TOC Subcategory defined in Sec. 268.40 of this chapter, Table Treatment Standards for Hazardous Wastes), or reactive (D003) waste, to remove the characteristic before land disposal, the owner/operator must comply with the requirements set out in Sec. 264.17(b).

(7) [Reserved]

(8)(i) Except as provided in paragraph (g)(8)(ii) of this section, a person engaged in treatment or containment activities during immediate response to any of the following situations:

(A) A discharge of a hazardous waste;

(B) An imminent and substantial threat of a discharge of hazardous waste;

(C) A discharge of a material which, when discharged, becomes a hazardous waste.

(D) An immediate threat to human health, public safety, property, or the environment, from the known or suspected presence of military munitions, other explosive material, or an explosive device, as determined by an explosive or munitions emergency response specialist as defined in 40 CFR 260.10.

(ii) An owner or operator of a facility otherwise regulated by this part must comply with all applicable requirements of subparts C and D.

(iii) Any person who is covered by paragraph (g)(8)(i) of this section and who continues or initiates hazardous waste treatment or containment activities after the immediate response is over is subject to all applicable requirements of this part and parts 122 through 124 of this chapter for those activities.

(iv) In the case of an explosives or munitions emergency response, if a Federal, State, Tribal or local official acting within the scope of his or her official responsibilities, or an explosives or munitions emergency response specialist, determines that immediate removal of the material or waste is necessary to protect human health or the environment, that official or specialist may authorize the removal of the material or waste by transporters who do not have EPA identification numbers and without the preparation of a manifest. In the case of emergencies involving military munitions, the responding military emergency response specialist's organizational unit must retain records for three years identifying the dates of the response, the responsible persons responding, the type and description of material addressed, and its disposition.

(9) A transporter storing manifested shipments of hazardous waste in containers meeting the requirements of 40 CFR 262.30 at a transfer facility for a period of ten days or less.

(10) The addition of absorbent material to waste in a container (as defined in Sec. 260.10 of this chapter) or the addition of waste to absorbent material in a container, provided that these actions occur at the time waste is first placed in the container; and Sec. Sec. 264.17(b), 264.171, and 264.172 are complied with.

(11) Universal waste handlers and universal waste transporters (as

defined in 40 CFR 260.10) handling the wastes listed below. These handlers are subject to regulation under 40 CFR part 273, when handling the below listed universal wastes.

- (i) Batteries as described in 40 CFR 273.2;
- (ii) Pesticides as described in Sec. 273.3 of this chapter;
- (iii) Thermostats as described in Sec. 273.4 of this chapter; and

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- (iv) Lamps as described in Sec. 273.5 of this chapter.

(12) A New York State Utility central collection facility consolidating hazardous waste in accordance with 40 CFR 262.90.

(h) The requirements of this part apply to owners or operators of all facilities which treat, store, or dispose of hazardous wastes referred to in part 268.

(i) Section 266.205 of this chapter identifies when the requirements of this part apply to the storage of military munitions classified as solid waste under Sec. 266.202 of this chapter. The treatment and disposal of hazardous waste military munitions are subject to the applicable permitting, procedural, and technical standards in 40 CFR parts 260 through 270.

(j) The requirements of subparts B, C, and D of this part and Sec. 264.101 do not apply to remediation waste management sites. (However, some remediation waste management sites may be a part of a facility that is subject to a traditional RCRA permit because the facility is also treating, storing or disposing of hazardous wastes that are not remediation wastes. In these cases, Subparts B, C, and D of this part, and Sec. 264.101 do apply to the facility subject to the traditional RCRA permit.) Instead of the requirements of subparts B, C, and D of this part, owners or operators of remediation waste management sites must:

(1) Obtain an EPA identification number by applying to the Administrator using EPA Form 8700-12;

(2) Obtain a detailed chemical and physical analysis of a representative sample of the hazardous remediation wastes to be managed at the site. At a minimum, the analysis must contain all of the information which must be known to treat, store or dispose of the waste according to this part and part 268 of this chapter, and must be kept accurate and up to date;

(3) Prevent people who are unaware of the danger from entering, and minimize the possibility for unauthorized people or livestock to enter onto the active portion of the remediation waste management site, unless the owner or operator can demonstrate to the Director that:

(i) Physical contact with the waste, structures, or equipment within the active portion of the remediation waste management site will not injure people or livestock who may enter the active portion of the remediation waste management site; and

(ii) Disturbance of the waste or equipment by people or livestock who enter onto the active portion of the remediation waste management site, will not cause a violation of the requirements of this part;

(4) Inspect the remediation waste management site for malfunctions, deterioration, operator errors, and discharges that may be causing, or may lead to, a release of hazardous waste constituents to the environment, or a threat to human health. The owner or operator must conduct these inspections often enough to identify problems in time to correct them before they harm human health or the environment, and must remedy the problem before it leads to a human health or environmental hazard. Where a hazard is imminent or has already occurred, the owner/operator must take remedial action immediately;

(5) Provide personnel with classroom or on-the-job training on how

to perform their duties in a way that ensures the remediation waste management site complies with the requirements of this part, and on how to respond effectively to emergencies;

(6) Take precautions to prevent accidental ignition or reaction of ignitable or reactive waste, and prevent threats to human health and the environment from ignitable, reactive and incompatible waste;

(7) For remediation waste management sites subject to regulation under subparts I through O and subpart X of this part, the owner/operator must design, construct, operate, and maintain a unit within a 100-year floodplain to prevent washout of any hazardous waste by a 100-year flood, unless the owner/operator can meet the demonstration of Sec. 264.18(b);

(8) Not place any non-containerized or bulk liquid hazardous waste in any salt dome formation, salt bed formation, underground mine or cave;

(9) Develop and maintain a construction quality assurance program for all

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surface impoundments, waste piles and landfill units that are required to comply with Sec. Sec. 264.221(c) and (d), 264.251(c) and (d), and 264.301(c) and (d) at the remediation waste management site, according to the requirements of Sec. 264.19;

(10) Develop and maintain procedures to prevent accidents and a contingency and emergency plan to control accidents that occur. These procedures must address proper design, construction, maintenance, and operation of remediation waste management units at the site. The goal of the plan must be to minimize the possibility of, and the hazards from a fire, explosion, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water that could threaten human health or the environment. The plan must explain specifically how to treat, store and dispose of the hazardous remediation waste in question, and must be implemented immediately whenever a fire, explosion, or release of hazardous waste or hazardous waste constituents which could threaten human health or the environment;

(11) Designate at least one employee, either on the facility premises or on call (that is, available to respond to an emergency by reaching the facility quickly), to coordinate all emergency response measures. This emergency coordinator must be thoroughly familiar with all aspects of the facility's contingency plan, all operations and activities at the facility, the location and characteristics of waste handled, the location of all records within the facility, and the facility layout. In addition, this person must have the authority to commit the resources needed to carry out the contingency plan;

(12) Develop, maintain and implement a plan to meet the requirements in paragraphs (j)(2) through (j)(6) and (j)(9) through (j)(10) of this section; and

(13) Maintain records documenting compliance with paragraphs (j)(1) through (j)(12) of this section.

[45 FR 33221, May 19, 1980, as amended at 45 FR 76075, Nov. 17, 1980; 45 FR 86968, Dec. 31, 1980; 46 FR 27480, May 20, 1981; 47 FR 8306, Feb. 25, 1982; 47 FR 32384, July 26, 1982; 48 FR 2511, Jan. 19, 1983; 48 FR 14294, Apr. 1, 1983; 50 FR 665, Jan. 4, 1985; 50 FR 28746, July 15, 1985; 52 FR 21016, June 4, 1987; 53 FR 27165, July 19, 1988; 58 FR 26, May 3, 1993; 58 FR 29884, May 24, 1993; 59 FR 48042, Sept. 19, 1994; 60 FR 25542, May 11, 1995; 62 FR 6651, Feb. 12, 1997; 63 FR 65938, Nov. 30, 1998; 64 FR 36487, July 6, 1999; 64 FR 37638, July 12, 1999]



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TITLE 40--PROTECTION OF ENVIRONMENT

CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY (CONTINUED)

PART 264 STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS WASTE TREATMENT,  
STORAGE, AND DISPOSAL FACILITIES--Table of Contents

Subpart F Releases From Solid Waste Management Units

Sec. 264.101 Corrective action for solid waste management units.

(a) The owner or operator of a facility seeking a permit for the treatment, storage or disposal of hazardous waste must institute corrective action as necessary to protect human health and the environment for all releases of hazardous waste or constituents from any solid waste management unit at the facility, regardless of the time at which waste was placed in such unit.

(b) Corrective action will be specified in the permit in accordance with this section and subpart S of this part. The permit will contain schedules of compliance for such corrective action (where such corrective action cannot be completed prior to issuance of the permit) and assurances of financial responsibility for completing such corrective action.

(c) The owner or operator must implement corrective actions beyond the facility property boundary, where necessary to protect human health and the environment, unless the owner or operator demonstrates to the satisfaction of the Regional Administrator that, despite the owner's or operator's best efforts, the owner or operator was unable to obtain the necessary permission to undertake such actions. The owner/operator is not relieved of all responsibility to clean up a release that has migrated beyond the facility boundary where off-site access is denied. On-site measures to address such releases will be determined on a case-by-case basis. Assurances of financial responsibility for such corrective action must be provided.

(d) This does not apply to remediation waste management sites unless they are part of a facility subject to a

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permit for treating, storing or disposing of hazardous wastes that are not remediation wastes.

[50 FR 28747, July 15, 1985, as amended at 52 FR 45798, Dec. 1, 1987; 58 FR 8683, Feb. 16, 1993; 63 FR 65938, Nov. 30, 1998]



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CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY (CONTINUED)

PART 264 STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS WASTE TREATMENT,  
STORAGE, AND DISPOSAL FACILITIES--Table of Contents

Subpart N Landfills

Sec. 264.310 Closure and post-closure care.

(a) At final closure of the landfill or upon closure of any cell, the owner or operator must cover the landfill or cell with a final cover designed and constructed to:

- (1) Provide long-term minimization of migration of liquids through the closed landfill;
- (2) Function with minimum maintenance;
- (3) Promote drainage and minimize erosion or abrasion of the cover;
- (4) Accommodate settling and subsidence so that the cover's integrity is maintained; and
- (5) Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.

(b) After final closure, the owner or operator must comply with all post-closure requirements contained in Sec. Sec. 264.117 through 264.120, including maintenance and monitoring throughout the post-closure care period (specified in the permit under Sec. 264.117). The owner or operator must:

- (1) Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events;
- (2) Continue to operate the leachate collection and removal system until leachate is no longer detected;
- (3) Maintain and monitor the leak detection system in accordance with Sec. Sec. 264.301(c)(3)(iv) and (4) and 264.303(c), and comply with all other applicable

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leak detection system requirements of this part;

- (4) Maintain and monitor the ground-water monitoring system and comply with all other applicable requirements of subpart F of this part;
- (5) Prevent run-on and run-off from eroding or otherwise damaging the final cover; and
- (6) Protect and maintain surveyed benchmarks used in complying with Sec. 264.309.

[47 FR 32365, July 26, 1982, as amended at 50 FR 28748, July 15, 1985;  
57 FR 3491, Jan. 29, 1992]

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PART 265\_INTERIM STATUS STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS  
WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES--Table of Contents

Subpart N\_Landfills

Sec. 265.314 Special requirements for bulk and containerized liquids.

(a) Bulk or non-containerized liquid waste or waste containing free liquids may be placed in a landfill prior to May 8, 1985 only if:

(1) The landfill has a liner and leachate collection and removal system that meets the requirements of Sec. 264.301(a) of this chapter; or

(2) Before disposal, the liquid waste or waste containing free liquids is treated or stabilized, chemically or physically (e.g., by mixing with a sorbent solid), so that free liquids are no longer present.

(b) Effective May 8, 1985, the placement of bulk or non-containerized liquid hazardous waste or hazardous waste containing free liquids (whether or not sorbents have been added) in any landfill is prohibited.

(c) Containers holding free liquids must not be placed in a landfill unless:

(1) All free-standing liquid,  
(i) has been removed by decanting, or other methods,  
(ii) has been mixed with sorbent or solidified so that free-standing liquid is no longer observed; or  
(iii) had been otherwise eliminated; or

(2) The container is very small, such as an ampule; or

(3) The container is designed to hold free liquids for use other than storage, such as a battery or capacitor; or

(4) The container is a lab pack as defined in Sec. 265.316 and is disposed of in accordance with Sec. 265.316.

(d) To demonstrate the absence or presence of free liquids in either a containerized or a bulk waste, the following test must be used: Method 9095 (Paint Filter Liquids Test) as described in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846, as incorporated by reference in Sec. 260.11 of this chapter.

(e) The date for compliance with paragraph (a) of this section is November 19, 1981. The date for compliance with paragraph (c) of this section is March 22, 1982.

(f) Sorbents used to treat free liquids to be disposed of in landfills must be nonbiodegradable. Nonbiodegradable sorbents are: materials listed or described in paragraph (f)(1) of this section; materials that pass one of the tests in paragraph (f)(2) of this section; or materials that are determined by EPA to be nonbiodegradable through the Part 260 petition process.

(1) Nonbiodegradable sorbents. (i) Inorganic minerals, other inorganic materials, and elemental carbon (e.g., aluminosilicates,

clays, smectites, Fuller's earth, bentonite, calcium bentonite, montmorillonite, calcined montmorillonite, kaolinite, micas (illite), vermiculites, zeolites; calcium carbonate (organic free limestone); oxides/hydroxides, alumina, lime, silica (sand), diatomaceous earth; perlite (volcanic glass); expanded volcanic rock; volcanic ash; cement kiln dust; fly ash; rice hull ash; activated charcoal/activated carbon); or

(ii) High molecular weight synthetic polymers (e.g., polyethylene, high density polyethylene (HDPE), polypropylene, polystyrene, polyurethane, polyacrylate, polynorborene,

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polysobutylene, ground synthetic rubber, cross-linked allylstyrene and tertiary butyl copolymers). This does not include polymers derived from biological material or polymers specifically designed to be degradable; or

(iii) Mixtures of these non bio degrad a ble materials.

(2) Tests for non bio degrad a ble sorbents. (i) The sorbent material is determined to be non bio degrad a ble under ASTM Method G21-70 (1984a)--Standard Practice for Determining Resistance of Synthetic Polymer Materials to Fungi; or

(ii) The sorbent material is determined to be nonbiodegradable under ASTM Method G22-76 (1984b)--Standard Practice for Determining Resistance of Plastics to Bacteria; or

(iii) The sorbent material is determined to be non-biodegradable under OECD test 301B: [CO<INF>2</INF> Evolution (Modified Sturm Test)].

(g) Effective November 8, 1985, the placement of any liquid which is not a hazardous waste in a landfill is prohibited unless the owner or operator of such landfill demonstrates to the Regional Administrator, or the Regional Administrator determines, that:

(1) The only reasonably available alternative to the placement in such landfill is placement in a landfill or unlined surface impoundment, whether or not permitted or operating under interim status, which contains, or may reasonably be anticipated to contain, hazardous waste; and

(2) Placement in such owner or operator's landfill will not present a risk of contamination of any underground source of drinking water (as that term is defined in Sec. 144.3 of this chapter).

[45 FR 33232, May 19, 1980, as amended at 47 FR 12318, Mar. 22, 1982; 47 FR 32369, July 26, 1982; 50 FR 18374, Apr. 30, 1985; 50 FR 28750, July 15, 1985; 51 FR 19177, May 28, 1986; 57 FR 54461, Nov. 18, 1992; 58 FR 46050, Aug. 31, 1993; 60 FR 35705, July 11, 1995]

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PART 264 STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS WASTE TREATMENT,  
STORAGE, AND DISPOSAL FACILITIES--Table of Contents

Subpart N\_Landfills

Sec. 264.314 Special requirements for bulk and containerized liquids.

(a) Bulk or non-containerized liquid waste or waste containing free liquids may be placed in a landfill prior to May 8, 1985 only if:

(1) The landfill has a liner and leachate collection and removal system that meet the requirements of Sec. 264.301(a); or

(2) Before disposal, the liquid waste or waste containing free liquids is treated or stabilized, chemically or physically (e.g., by mixing with a sorbent solid), so that free liquids are no longer present.

(b) Effective May 8, 1985, the placement of bulk or non-containerized liquid hazardous waste or hazardous waste containing free liquids (whether or not sorbents have been added) in any landfill is prohibited.

(c) To demonstrate the absence or presence of free liquids in either a containerized or a bulk waste, the following test must be used: Method 9095 (Paint Filter Liquids Test) as described in ``Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,' ' EPA Publication SW-846, as incorporated by reference in Sec. 260.11 of this chapter.

(d) Containers holding free liquids must not be placed in a landfill unless:

(1) All free-standing liquid:

(i) Has been removed by decanting, or other methods;

(ii) Has been mixed with sorbent or solidified so that free-standing liquid is no longer observed; or

(iii) Has been otherwise eliminated; or

(2) The container is very small, such as an ampule; or

(3) The container is designed to hold free liquids for use other than storage, such as a battery or capacitor; or

(4) The container is a lab pack as defined in Sec. 264.316 and is disposed of in accordance with Sec. 264.316.

(e) Sorbents used to treat free liquids to be disposed of in landfills must be

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nonbiodegradable. Nonbiodegradable sorbents are: materials listed or described in paragraph (e)(1) of this section; materials that pass one of the tests in paragraph (e)(2) of this section; or materials that are determined by EPA to be nonbiodegradable through the part 260 petition process.

(1) Nonbiodegradable sorbents. (i) Inorganic minerals, other inorganic materials, and elemental carbon (e.g., aluminosilicates,

clays, smectites, Fuller's earth, bentonite, calcium bentonite, montmorillonite, calcined montmorillonite, kaolinite, micas (illite), vermiculites, zeolites; calcium carbonate (organic free limestone); oxides/hydroxides, alumina, lime, silica (sand), diatomaceous earth; perlite (volcanic glass); expanded volcanic rock; volcanic ash; cement kiln dust; fly ash; rice hull ash; activated charcoal/activated carbon); or

(ii) High molecular weight synthetic polymers (e.g., polyethylene, high density polyethylene (HDPE), polypropylene, polystyrene, polyurethane, polyacrylate, polynorborene, polyisobutylene, ground synthetic rubber, cross-linked allylstyrene and tertiary butyl copolymers). This does not include polymers derived from biological material or polymers specifically designed to be degradable; or

(iii) Mixtures of these non bio de grad a ble materials.

(2) Tests for nonbiodegradable sorbents. (i) The sorbent material is determined to be nonbiodegradable under ASTM Method G21-70 (1984a)--Standard Practice for Determining Resistance of Synthetic Polymer Materials to Fungi; or

(ii) The sorbent material is determined to be nonbiodegradable under ASTM Method G22-76 (1984b)--Standard Practice for Determining Resistance of Plastics to Bacteria; or

(iii) The sorbent material is determined to be non-biodegradable under OECD test 301B: [CO<INF>2</INF> Evolution (Modified Sturm Test)].

(f) Effective November 8, 1985, the placement of any liquid which is not a hazardous waste in a landfill is prohibited unless the owner or operator of such landfill demonstrates to the Regional Administrator, or the Regional Administrator determines, that:

(1) The only reasonably available alternative to the placement in such landfill is placement in a landfill or unlined surface impoundment, whether or not permitted or operating under interim status, which contains, or may reasonably be anticipated to contain, hazardous waste; and

(2) Placement in such owner or operator's landfill will not present a risk of contamination of any underground source of drinking water (as that term is defined in Sec. 144.3 of this chapter.)

[47 FR 32365, July 26, 1982, as amended at 50 FR 18374, Apr. 30, 1985; 50 FR 28748, July 15, 1985; 57 FR 54460, Nov. 18, 1992; 58 FR 46050, Aug. 31, 1993; 60 FR 35705, July 11, 1995]

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PART 264 STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS WASTE TREATMENT,  
STORAGE, AND DISPOSAL FACILITIES--Table of Contents

Subpart N\_Landfills

Sec. 264.315 Special requirements for containers.

Unless they are very small, such as an ampule, containers must be  
either:  
    (a) At least 90 percent full when placed in the landfill; or  
    (b) Crushed, shredded, or similarly reduced in volume to the maximum  
practical extent before burial in the landfill.

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WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES--Table of Contents

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Subpart A General

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Appendix V to Part 265--Examples of Potentially Incompatible Waste

Appendix VI to Part 265--Compounds With Henry's Law Constant Less Than 0.1 Y/X

Authority: 42 U.S.C. 6905, 6906, 6912, 6922, 6923, 6924, 6925, 6935, 6936, and 6937, unless otherwise noted.

Source: 45 FR 33232, May 19, 1980, unless otherwise noted.

(a) The purpose of this part is to establish minimum national standards that define the acceptable management of hazardous waste during the period of interim status and until certification of final closure or, if the facility is subject to post-closure requirements, until

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post-closure responsibilities are fulfilled.

(b) Except as provided in Sec. 265.1080(b), the standards of this part and of 40 CFR 264.552, 264.553, and 264.554, apply to owners and operators of facilities that treat, store or dispose of hazardous waste who have fully complied with the requirements for interim status under

section 3005(e) of RCRA and Sec. 270.10 of this chapter until either a permit is issued under section 3005 of RCRA or until applicable part 265 closure and post-closure responsibilities are fulfilled, and to those owners and operators of facilities in existence on November 19, 1980 who have failed to provide timely notification as required by section 3010(a) of RCRA and/or failed to file Part A of the permit application as required by 40 CFR 270.10 (e) and (g). These standards apply to all treatment, storage and disposal of hazardous waste at these facilities after the effective date of these regulations, except as specifically provided otherwise in this part or part 261 of this chapter.

[Comment: As stated in section 3005(a) of RCRA, after the effective date of regulations under that section (i.e., parts 270 and 124 of this chapter), the treatment, storage and disposal of hazardous waste is prohibited except in accordance with a permit. Section 3005(e) of RCRA provides for the continued operation of an existing facility that meets certain conditions, until final administrative disposition of the owner's and operator's permit application is made.]

(c) The requirements of this part do not apply to:

(1) A person disposing of hazardous waste by means of ocean disposal subject to a permit issued under the Marine Protection, Research, and Sanctuaries Act;

[Comment: These part 265 regulations do apply to the treatment or storage of hazardous waste before it is loaded onto an ocean vessel for incineration or disposal at sea, as provided in paragraph (b) of this section.]

(2) [Reserved]

(3) The owner or operator of a POTW which treats, stores, or disposes of hazardous waste;

[Comment: The owner or operator of a facility under paragraphs (c)(1) through (3) of this section is subject to the requirements of part 264 of this chapter to the extent they are included in a permit by rule granted to such a person under part 122 of this chapter, or are required by Sec. 144.14 of this chapter.]

(4) A person who treats, stores, or disposes of hazardous waste in a State with a RCRA hazardous waste program authorized under subpart A or B of part 271 of this chapter, except that the requirements of this part will continue to apply:

(i) As stated in paragraph (c)(2) of this section, if the authorized State RCRA program does not cover disposal of hazardous waste by means of underground injection; or

(ii) To a person who treats, stores, or disposes of hazardous waste in a State authorized under subpart A or B of part 271 of this chapter if the State has not been authorized to carry out the requirements and prohibitions applicable to the treatment, storage, or disposal of hazardous waste at his facility which are imposed pursuant to the Hazardous and Solid Waste Act Amendments of 1984. The requirements and prohibitions that are applicable until a State receives authorization to carry them out include all Federal program requirements identified in Sec. 271.1(j);

(5) The owner or operator of a facility permitted, licensed, or registered by a State to manage municipal or industrial solid waste, if the facility only handles hazardous waste the facility treats, stores, or disposes of is excluded from regulation under this part by Sec. 261.5 of this chapter;

(6) The owner or operator of a facility managing recyclable

materials described in Sec. 261.6 (a)(2), (3), and (4) of this chapter (except to the extent they are referred to in part 279 or sub parts C, D or G of part 266 of this chapter).

(7) A generator accumulating waste on-site in compliance with Sec. 262.34 of this chapter, except to the extent the requirements are included in Sec. 262.34 of this chapter;

(8) A farmer disposing of waste pesticides from his own use in compliance with Sec. 262.70 of this chapter; or

(9) The owner or operator of a totally enclosed treatment facility, as defined in Sec. 260.10.

(10) The owner or operator of an elementary neutralization unit or a

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wastewater treatment unit as defined in Sec. 260.10 of this chapter, provided that if the owner or operator is diluting hazardous ignitable (D001) wastes (other than the D001 High TOC Subcategory defined in Sec. 268.40 of this chapter, Table Treatment Standards for Hazardous Wastes), or reactive (D003) waste, to remove the characteristic before land disposal, the owner/operator must comply with the requirements set out in Sec. 265.17(b).

(11)(i) Except as provided in paragraph (c)(11)(ii) of this section, a person engaged in treatment or containment activities during immediate response to any of the following situations:

(A) A discharge of a hazardous waste;

(B) An imminent and substantial threat of a discharge of a hazardous waste;

(C) A discharge of a material which, when discharged, becomes a hazardous waste.

(D) An immediate threat to human health, public safety, property, or the environment, from the known or suspected presence of military munitions, other explosive material, or an explosive device, as determined by an explosive or munitions emergency response specialist as defined in 40 CFR 260.10.

(ii) An owner or operator of a facility otherwise regulated by this part must comply with all applicable requirements of subparts C and D.

(iii) Any person who is covered by paragraph (c)(11)(i) of this section and who continues or initiates hazardous waste treatment or containment activities after the immediate response is over is subject to all applicable requirements of this part and parts 122 through 124 of this chapter for those activities.

(iv) In the case of an explosives or munitions emergency response, if a Federal, State, Tribal or local official acting within the scope of his or her official responsibilities, or an explosives or munitions emergency response specialist, determines that immediate removal of the material or waste is necessary to protect human health or the environment, that official or specialist may authorize the removal of the material or waste by transporters who do not have EPA identification numbers and without the preparation of a manifest. In the case of emergencies involving military munitions, the responding military emergency response specialist's organizational unit must retain records for three years identifying the dates of the response, the responsible persons responding, the type and description of material addressed, and its disposition.

(12) A transporter storing manifested shipments of hazardous waste in containers meeting the requirements of 40 CFR 262.30 at a transfer facility for a period of ten days or less.

(13) The addition of absorbent material to waste in a container (as defined in Sec. 260.10 of this chapter) or the addition of waste to the absorbent material in a container provided that these actions occur at

the time waste is first placed in the containers; and Sec. Sec. 265.17(b), 265.171, and 265.172 are complied with.

(14) Universal waste handlers and universal waste transporters (as defined in 40 CFR 260.10) handling the wastes listed below. These handlers are subject to regulation under 40 CFR part 273, when handling the below listed universal wastes.

- (i) Batteries as described in 40 CFR 273.2;
- (ii) Pesticides as described in Sec. 273.3 of this chapter;
- (iii) Thermostats as described in Sec. 273.4 of this chapter; and
- (iv) Lamps as described in Sec. 273.5 of this chapter.

(15) A New York State Utility central collection facility consolidating hazardous waste in accordance with 40 CFR 262.90.

(d) The following hazardous wastes must not be managed at facilities subject to regulation under this part.

(1) EPA Hazardous Waste Nos. FO20, FO21, FO22, FO23, FO26, or FO27 unless:

- (i) The wastewater treatment sludge is generated in a surface impoundment as part of the plant's wastewater treatment system;
- (ii) The waste is stored in tanks or containers;
- (iii) The waste is stored or treated in waste piles that meet the requirements of Sec. 264.250(c) as well as all other applicable requirements of subpart L of this part;

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(iv) The waste is burned in incinerators that are certified pursuant to the standards and procedures in Sec. 265.352; or

(v) The waste is burned in facilities that thermally treat the waste in a device other than an incinerator and that are certified pursuant to the standards and procedures in Sec. 265.383.

(e) The requirements of this part apply to owners or operators of all facilities which treat, store or dispose of hazardous waste referred to in 40 CFR part 268, and the 40 CFR part 268 standards are considered material conditions or requirements of the part 265 interim status standards.

(f) Section 266.205 of this chapter identifies when the requirements of this part apply to the storage of military munitions classified as solid waste under Sec. 266.202 of this chapter. The treatment and disposal of hazardous waste military munitions are subject to the applicable permitting, procedural, and technical standards in 40 CFR parts 260 through 270.

[45 FR 33232, May 19, 1980]

Editorial Note: For Federal Register citations affecting Sec. 265.1, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and on GPO Access.

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TITLE 40--PROTECTION OF ENVIRONMENT

CHAPTER I--ENVIRONMENTAL PROTECTION  
AGENCY (CONTINUED)

PART 268 LAND DISPOSAL RESTRICTIONS--Table of Contents

Subpart A\_General

Sec. 268.2 Definitions applicable in this part.

When used in this part the following terms have the meanings given below:

(a) Halogenated organic compounds or HOCs means those compounds having a carbon-halogen bond which are listed under appendix III to this part.

(b) Hazardous constituent or constituents means those constituents listed in appendix VIII to part 261 of this chapter.

(c) Land disposal means placement in or on the land, except in a corrective action management unit or staging pile, and includes, but is not limited to, placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, underground mine or cave, or placement in a concrete vault, or bunker intended for disposal purposes.

(d) Nonwastewaters are wastes that do not meet the criteria for wastewaters in paragraph (f) of this section.

(e) Polychlorinated biphenyls or PCBs are halogenated organic compounds defined in accordance with 40 CFR 761.3.

(f) Wastewaters are wastes that contain less than 1% by weight total organic carbon (TOC) and less than 1% by weight total suspended solids (TSS).

(g) Debris means solid material exceeding a 60 mm particle size that is intended for disposal and that is: A manufactured object; or plant or animal matter; or natural geologic material. However, the following materials are not debris: Any material for which a specific treatment standard is provided in Subpart D, Part 268, namely lead acid batteries, cadmium batteries, and radioactive lead solids; Process residuals such as smelter slag and residues from the treatment of waste, wastewater, sludges, or air emission residues; and Intact containers of hazardous waste that are not ruptured and that retain at least 75% of their original volume. A mixture of debris that has not been treated to the standards provided by Sec. 268.45 and other material is subject to regulation as debris if the mixture is comprised primarily of debris, by volume, based on visual inspection.

(h) Hazardous debris means debris that contains a hazardous waste listed in subpart D of part 261 of this chapter, or that exhibits a characteristic of hazardous waste identified in subpart C of part 261 of this chapter. Any deliberate mixing of prohibited hazardous waste with debris that changes its treatment classification (i.e., from waste to hazardous debris) is not allowed under the dilution prohibition in Sec. 268.3.

(i) Underlying hazardous constituent means any constituent listed in



Sec. 268.48, Table UTS--Universal Treatment Standards, except fluoride, selenium, sulfides, vanadium, and zinc, which can reasonably be expected to be present at the point of generation of the hazardous waste at a concentration above the constituent-specific UTS treatment standards.

(j) Inorganic metal-bearing waste is one for which EPA has established treatment standards for metal hazardous constituents, and which does not otherwise contain significant organic or cyanide content as described in Sec. 268.3(c)(1), and is specifically listed in appendix XI of this part.

(k) Soil means unconsolidated earth material composing the superficial geologic strata (material overlying bedrock), consisting of clay, silt, sand, or gravel size particles as classified by the U.S. Natural Resources Conservation Service, or a mixture of such materials with liquids, sludges or solids which is inseparable by simple mechanical removal processes and is made up primarily of soil by volume based on visual inspection. Any deliberate mixing of prohibited hazardous waste with

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soil that changes its treatment classification (i.e., from waste to contaminated soil) is not allowed under the dilution prohibition in Sec. 268.3.

[55 FR 22686, June 1, 1990, as amended at 56 FR 3877, Jan. 31, 1991; 57 FR 37270, Aug. 18, 1992; 58 FR 8685, Feb. 16, 1993; 58 FR 29884, May 24, 1993; 59 FR 48043, Sept. 19, 1994; 60 FR 244, Jan. 3, 1995; 61 FR 15597, 15662, Apr. 8, 1996; 61 FR 33682, June 28, 1996; 63 FR 28639, May 26, 1998; 63 FR 65940, Nov. 30, 1998; 64 FR 25414, May 11, 1999]

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TITLE 40--PROTECTION OF ENVIRONMENT

CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY (CONTINUED)

PART 264 STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS WASTE TREATMENT,  
STORAGE, AND DISPOSAL FACILITIES--Table of Contents

Subpart S\_Special Provisions for Cleanup

Sec. 264.553 Temporary Units (TU).

(a) For temporary tanks and container storage areas used to treat or store hazardous remediation wastes during remedial activities required under Sec. 264.101 or RCRA 3008(h), or at a permitted facility that is not subject to Sec. 264.101, the Regional Administrator may designate a unit at the facility, as a temporary unit. A temporary unit must be located within the contiguous property under the control of the owner/operator where the wastes to be managed in the temporary unit originated. For temporary units, the Regional Administrator may replace the design, operating, or closure standard applicable to these units under this part 264 or part 265 of this chapter with alternative requirements which protect human health and the environment.

(b) Any temporary unit to which alternative requirements are applied in accordance with paragraph (a) of this section shall be:

- (1) Located within the facility boundary; and
- (2) Used only for treatment or storage of remediation wastes.

(c) In establishing standards to be applied to a temporary unit, the Regional Administrator shall consider the following factors:

- (1) Length of time such unit will be in operation;
- (2) Type of unit;
- (3) Volumes of wastes to be managed;
- (4) Physical and chemical characteristics of the wastes to be managed in the unit;
- (5) Potential for releases from the unit;
- (6) Hydrogeological and other relevant environmental conditions at the facility which may influence the migration of any potential releases; and
- (7) Potential for exposure of humans and environmental receptors if releases were to occur from the unit.

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(d) The Regional Administrator shall specify in the permit or order the length of time a temporary unit will be allowed to operate, to be no longer than a period of one year. The Regional Administrator shall also specify the design, operating, and closure requirements for the unit.

(e) The Regional Administrator may extend the operational period of a temporary unit once for no longer than a period of one year beyond the originally specified in the permit or order, if the Administrator determines that:

- (1) Continued operation of the unit will not pose a threat to human health and the environment; and

(2) Continued operation of the unit is necessary to ensure timely and efficient implementation of remedial actions at the facility.

(f) Incorporation of a temporary unit or a time extension for a temporary unit into an existing permit shall be:

(1) Approved in accordance with the procedures for Agency-initiated permit modifications under Sec. 270.41; or

(2) Requested by the owner/operator as a Class II modification according to the procedures under Sec. 270.42 of this chapter.

(g) The Regional Administrator shall document the rationale for designating a temporary unit and for granting time extensions for temporary units and shall make such documentation available to the public.

[58 FR 8683, Feb. 16, 1993, as amended at 63 FR 65939, Nov. 30, 1998]

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TITLE 40--PROTECTION OF ENVIRONMENT

CHAPTER I--ENVIRONMENTAL PROTECTION  
AGENCY (CONTINUED)

PART 268\_LAND DISPOSAL RESTRICTIONS--Table of Contents

Subpart D\_Treatment Standards

Sec. 268.44 Variance from a treatment standard.

(a) Based on a petition filed by a generator or treater of hazardous waste, the Administrator may approve a variance from an applicable treatment standard if:

(1) It is not physically possible to treat the waste to the level specified in the treatment standard, or by the method specified as the treatment standard. To show that this is the case, the petitioner must demonstrate that because the physical or chemical properties of the waste differ significantly from waste analyzed in developing the treatment standard, the waste cannot be treated to the specified level or by the specified method; or

(2) It is inappropriate to require the waste to be treated to the level specified in the treatment standard or by the method specified as the treatment standard, even though such treatment is technically possible. To show that this is the case, the petitioner must either demonstrate that:

(i) Treatment to the specified level or by the specified method is technically inappropriate (for example, resulting in combustion of large amounts of mildly contaminated environmental media); or

(ii) For remediation waste only, treatment to the specified level or by the specified method is environmentally inappropriate because it would likely discourage aggressive remediation.

(b) Each petition must be submitted in accordance with the procedures in Sec. 260.20.

(c) Each petition must include the following statement signed by the petitioner or an authorized representative:

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this petition and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that these are significant penalties for submitting false information, including the possibility of fine and imprisonment.

(d) After receiving a petition for variance from a treatment standard, the Administrator may request any additional information or samples which he may require to evaluate the petition. Additional copies of the complete petition may be requested as needed to send to affected States and Regional Offices.

(e) The Administrator will give public notice in the Federal Register of the intent to approve or deny a petition and provide an

opportunity for public comment. The final decision on a variance from a treatment standard will be published in the Federal Register.

(f) A generator, treatment facility, or disposal facility that is managing a waste covered by a variance from the treatment standards must comply with the waste analysis requirements for restricted wastes found under Sec. 268.7.

(g) During the petition review process, the applicant is required to comply with all restrictions on land disposal under this part once the effective date for the waste has been reached.

(h) Based on a petition filed by a generator or treater of hazardous waste, the Administrator or his or her delegated representative may approve a site-specific variance from an applicable treatment standard if:

(1) It is not physically possible to treat the waste to the level specified in the treatment standard, or by the method specified as the treatment standard. To show that this is the case, the petitioner must demonstrate that because the physical or chemical properties of the waste differ significantly from waste analyzed in developing the treatment standard, the waste cannot be treated to the specified level or by the specified method; or

(2) It is inappropriate to require the waste to be treated to the level specified in the treatment standard or by the method specified as the treatment standard, even though such treatment is technically possible. To show that this is the case, the petitioner must either demonstrate that:

(i) Treatment to the specified level or by the specified method is technically inappropriate (for example, resulting in combustion of large amounts of mildly contaminated environmental media where the treatment standard is not based on combustion of such media); or

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(ii) For remediation waste only, treatment to the specified level or by the specified method is environmentally inappropriate because it would likely discourage aggressive remediation.

(3) For contaminated soil only, treatment to the level or by the method specified in the soil treatment standards would result in concentrations of hazardous constituents that are below (i.e., lower than) the concentrations necessary to minimize short- and long-term threats to human health and the environment. Treatment variances approved under this paragraph must:

(i) At a minimum, impose alternative land disposal restriction treatment standards that, using a reasonable maximum exposure scenario:

(A) For carcinogens, achieve constituent concentrations that result in the total excess risk to an individual exposed over a lifetime generally falling within a range from  $10^{-4}$  to  $10^{-6}$ ; and

(B) For constituents with non-carcinogenic effects, achieve constituent concentrations that an individual could be exposed to on a daily basis without appreciable risk of deleterious effect during a lifetime.

(ii) Not consider post-land-disposal controls.

(4) For contaminated soil only, treatment to the level or by the method specified in the soil treatment standards would result in concentrations of hazardous constituents that are below (i.e., lower than) natural background concentrations at the site where the contaminated soil will land disposed.

(5) Public notice and a reasonable opportunity for public comment must be provided before granting or denying a petition.

(i) Each application for a site-specific variance from a treatment

standard must include the information in Sec. 260.20(b) (1)-(4);

(j) After receiving an application for a site-specific variance from a treatment standard, the Assistant Administrator, or his delegated representative, may request any additional information or samples which may be required to evaluate the application.

(k) A generator, treatment facility, or disposal facility that is managing a waste covered by a site-specific variance from a treatment standard must comply with the waste analysis requirements for restricted wastes found under Sec. 268.7.

(l) During the application review process, the applicant for a site-specific variance must comply with all restrictions on land disposal under this part once the effective date for the waste has been reached.

(m) For all variances, the petitioner must also demonstrate that compliance with any given treatment variance is sufficient to minimize threats to human health and the environment posed by land disposal of the waste. In evaluating this demonstration, EPA may take into account whether a treatment variance should be approved if the subject waste is to be used in a manner constituting disposal pursuant to 40 CFR 266.20 through 266.23.

(n) [Reserved]

(o) The following facilities are excluded from the treatment standards under Sec. 268.40, and are subject to the following constituent concentrations:

Table--Wastes Excluded From the Treatment Standards Under				
Facility name\1\ and address	Waste code	See also	Regulated hazardous constituent	-- C
Craftsman Plating and Tinning, Corp., Chicago, IL.	F006	Table CCWE in 268.40.	Cyanides (Total).....	
	.....		Cyanides (Amenable)...	
	.....		Cadmium.....	
	.....		Chromium.....	
	.....		Lead.....	
CWM Chemical Services, LLC, Model City, New York.	K088\9\	Standards under Sec. 268.40.	Nickel.....	
			Arsenic.....	
Dupont Environmental Treatment-- Chambers Works Wastewater Treatment Plant, Deepwater, NJ \8\.	K088	Standards under Sec. 268.40.	Arsenic.....	
Guardian Industries Corp., Jefferson Hills, PA \6\ \11\.	D010	Standards under Sec. 268.40.	Selenium.....	
Owens Brockway Glass Container Company, Vernon CA \6\ \7\.	D010	Standards under Sec. 268.40.	Selenium.....	
Northwestern Plating Works, Inc., Chicago, IL.	F006	Table CCWE in 268.40.	Cyanides (Total).....	
	.....		Cyanides (Amenable)...	
	.....		Cadmium.....	
	.....		Chromium.....	
	.....		Lead.....	
	.....		Nickel.....	

St. Gobain Containers, El Monte, CA \5\ \7\.	D010	Standards under Sec. Selenium.....
		268.40.
U Ecology Idaho, Incorporated, K088\10\		Standards under Sec. Arsenic.....
view, Idaho.		268.40.

- (\1\)--A facility may certify compliance with these treatment standards according to provisions in 40 CFR Sec. 268.40.
- (\2\)--Cyanide Wastewater Standards for F006 are based on analysis of composite samples.
- (\3\)--These facilities must comply with 0.86 mg/l for amenable cyanides in the wastewater exiting the facility. Facilities must also comply with 40 CFR Sec. 268.7.a.4 for appropriate monitoring frequency consistent with the standards.
- (\4\)--Cyanide nonwastewaters are analyzed using SW-846 Method 9010 or 9012, sample size 10 grams.
- (\5\)--Alternative D010 selenium standard only applies to dry scrubber solid from glass manufacturing.
- (\6\)--Alternative D010 selenium standard only applies to electrostatic precipitator dust generated by these two facilities.
- (\7\)--D010 wastes generated by these two facilities must be treated by Chemical Waste Management, Inc., City, California.
- (\8\)--Dupont Environmental Treatment-Chambers Works must dispose of this waste in their on-site S010 treatment system.
- (\9\)--This treatment standard applies only to K088-derived bag house dust, incinerator ash, and filter cake.
- (\10\)--This treatment standard applies only to K088-derived air emission control dust generated by these two facilities.
- (\11\)--D010 wastes generated by this facility must be treated by Heritage Environmental Services, Inc., Indiana.

Note: NA means Not Applicable.

[51 FR 40642, Nov. 7, 1986, as amended at 52 FR 21017, June 4, 1987; 53 FR 31221, Aug. 17, 1988; 54 FR 36972, Sept. 6, 1989; 56 FR 12355, Mar. 25, 1991; 61 FR 55727, Oct. 28, 1996; 62 FR 26025, May 12, 1997; 62 FR 64509, Dec. 5, 1997; 63 FR 28738, May 26, 1998; 64 FR 28391, May 26, 1999; 66 FR 33890, June 26, 2001; 67 FR 35928, May 22, 2002; 67 FR 36818, May 28, 2002; 69 FR 6575, Feb. 11, 2004]

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TITLE 40--PROTECTION OF ENVIRONMENT

CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY (CONTINUED)

PART 265\_INTERIM STATUS STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS  
WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES--Table of Contents

Subpart G\_Closure and Post-Closure

Sec. 265.111 Closure performance standard.

The owner or operator must close the facility in a manner that:

(a) Minimizes the need for further maintenance, and

(b) Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere, and

(c) Complies with the closure requirements of this subpart, including, but not limited to, the requirements of Sec. Sec. 265.197, 265.228, 265.258, 265.280, 265.310, 265.351, 265.381, 265.404, and 265.102.

[51 FR 16451, May 2, 1986, as amended at 57 FR 37267, Aug. 18, 1992]





# Geosynthetic Clay Liners Used in Municipal Solid Waste Landfills

**T**his fact sheet describes new and innovative technologies and products that meet the performance standards of the Criteria for Municipal Solid Waste Landfills (40 CFR Part 258).

Geosynthetic clay liners (GCLs) represent a relatively new technology (developed in 1986) currently gaining acceptance as a barrier system in municipal solid waste landfill applications. Federal and some state regulations specify design standards for bottom liners and final covers. Alternative technologies are allowed, however, if they meet federal performance standards. GCL technology is an alternative that performs at or above standard federal performance levels.

GCL technology offers some unique advantages over conventional bottom liners and covers. GCLs, for example, are fast and easy to install, have low hydraulic conductivity (i.e., low permeability), and have the ability to self-repair any rips or holes caused by the swelling properties of the bentonite from which they are made. GCLs are cost-effective in regions where clay is not readily available. A GCL liner system is not as thick as a liner system involving the use of compacted clay, enabling engineers to construct landfills that maximize capacity while protecting area ground water.

The following ASTM standards have been developed which may be used for designing liner systems using GCLs as well as comparing GCL products:

- ASTM D5889 Standard Practice For Quality Control of GCLs.
- ASTM D5887 Standard Test Method for Measurement of Index Flux through Saturated GCL Specimens Using a Flexible Wall Permeameter.
- ASTM D5890 Standard Test Method for Swell Index of Clay Mineral Component of GCLs.
- ASTM D5891 Standard Test Method for Fluid Loss of Clay Liner Component of GCLs.
- ASTM D5993 Standard Test Method for Measuring Mass per Unit of GCLs.
- ASTM D6243 Standard Test Method for Determining the Internal and Interface Shear Resistance of GCL by Direct Shear Method.

This emerging technology is currently in use at a number of sites across the nation. This fact sheet provides information on this technology and presents case studies of successful applications.

## GCL Technology

### Materials

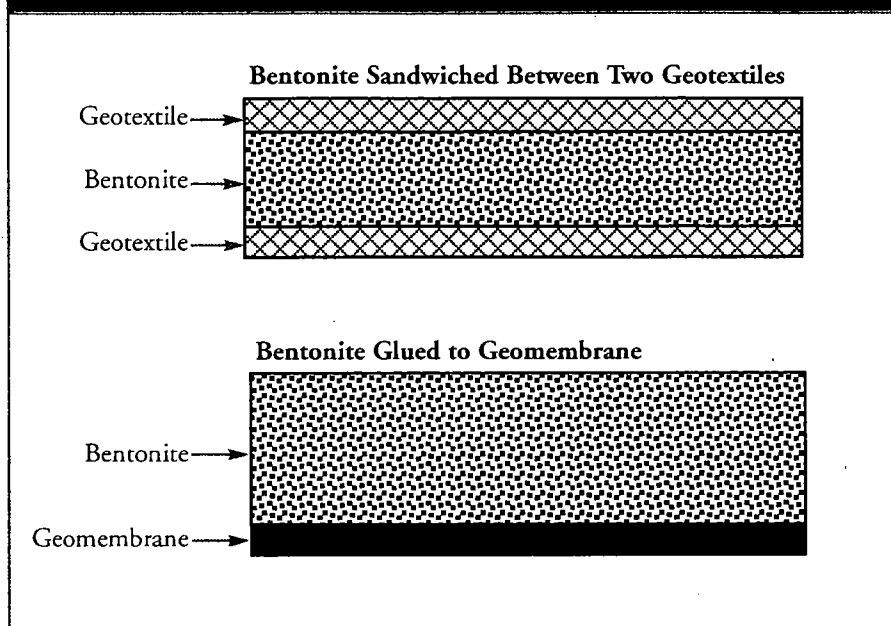
A GCL is a relatively thin layer of processed clay (typically bentonite) either bonded to a geomembrane or fixed between two sheets of geotextile. A geomembrane is a polymeric sheet material that is impervious to liquid as long as it maintains its integrity. A geotextile is a woven or nonwoven sheet material less impervious to liquid than a geomembrane, but more resistant to penetration damage. Both types of GCLs are illustrated in Figure 1. Although the overall configuration of the GCL affects its perfor-

mance characteristics, the primary performance factors are clay quality, amount of clay used per unit area, and uniformity.

Bentonite is an extremely absorbent, granular clay formed from volcanic ash. Bentonite attracts positively charged water particles; thus, it rapidly hydrates when exposed to liquid, such as water or leachate. As the clay hydrates it swells, giving it the ability to "self-heal" holes in the GCL. In laboratory tests on bentonite, researchers demonstrated that a hole up to 75 millimeters in diameter will seal itself, allowing the GCL to retain the properties that make it an effective barrier system.



**Figure 1. General Configurations of GCLs**



Bentonite is affixed to synthetic materials in a number of ways to form the GCL system. In configurations using a geomembrane, the clay is affixed using an adhesive. In geotextile configurations, however, adhesives, stitchbonding, needlepunching, or a combination of the three, are used. Although stitchbonding and needlepunching create small holes in the geotextile, these holes are sealed when the installed GCL's clay layer hydrates. Figure 2 shows cross-section views of the three separate approaches to affixing bentonite to a geotextile.

## Properties and Characteristics

An important criterion for selecting an effective landfill barrier system is hydraulic conductivity. Before choosing a barrier system, the landfill operator should test the technology under consideration to ensure that its hydraulic conductivity, as well as other characteristics, are appropriate for the particular landfill site.

### Hydraulic Conductivity

GCL technology can provide barrier systems with low hydraulic conductivity (i.e., low permeability), which is the rate at which a liquid passes through a material. Laboratory tests demonstrate that the hydraulic conductivity of dry, unconfined bentonite is approximately  $1 \times 10^{-6}$  cm/sec. When saturated, however, the hydraulic conductivity of bentonite typically drops to less than  $1 \times 10^{-9}$  cm/sec.

The quality of the clay used affects a GCL's hydraulic characteristics. Sodium bentonite, a naturally occurring compound in a silicate clay formed from volcanic ash, gives bentonite its distinct properties. Additives are used to enhance the hydraulic properties of clay containing low amounts of sodium bentonite.

Hydraulic performance also relates to the amount of bentonite per unit area and its uniformity. The more bentonite used per unit area, the lower the system's hydraulic conductivity. Although the amount of bentonite per

unit area varies with the particular GCL, manufacturers typically use 1 pound per square foot. As a result, the hydraulic conductivity of most GCL products ranges from about  $1 \times 10^{-9}$  cm/sec to less than  $1 \times 10^{-12}$  cm/sec. That is, the permeability of finished GCL products depends on a combination of factors, including the type and amount of bentonite; the amount of additives; the type of geosynthetic material; and the product configuration (i.e., the method of affixing the geosynthetic to the clay).

### Shear Strength and Other Characteristics

Depending on the particular configuration of the barrier system, GCL technology can provide considerable shear strength (i.e., the maximum stress a material can withstand without losing structural integrity). In particular, a geotextile-backed GCL, with bentonite affixed via stitchbonding, provides additional internal resistance to shear in the clay layer. Needle punching yields an even stronger, more rigid barrier. In addition, needle punching requires the use of a nonwoven geotextile on at least one side. These GCL configurations provide enhanced interface friction resistance to the adjoining layer, an important consideration for landfill slopes.

Both needle punching and stitchbonding, however, tend to increase the cost of the GCL product. Needle punching, in particular, adds to a GCL's cost, because nonwoven geotextiles are generally more expensive than woven geotextiles.

Before selecting a final barrier system, landfill operators should consider other important performance characteristics, such as free and confined swelling (i.e., whether the clay will provide a uniform barrier) and rate of creep, which measures the resistance to barrier deformation.

## Testing

GCL configurations for barrier systems are based on the design specifications of each specific project. The American Society for Testing and Materials (ASTM) developed standardized laboratory tests for assessing mass per unit area (ASTM D-3776), hydraulic conductivity (ASTM D-5084), and direct shear (ASTM D-5321).

Researchers at the Geosynthetic Research Institute at Drexel University (in Philadelphia, Pennsylvania) and the Geotechnical Engineering Department at the University of Texas (in Austin) developed tests to measure shear strength, as well as confined swelling, rate of creep, and seam overlap permeability. These test methods have been adopted by ASTM. Additionally, the bentonite industry developed a test to measure free swell (USP-NF-XVII).

Test values for hydraulic conductivity depend on the degree of effective overburden stress around the GCL during testing. The higher the effective overburden stress, the lower the hydraulic conductivity. When comparing two different bentonite products, both must be subjected to the same degree of effective overburden stress.

## Available GCL Products

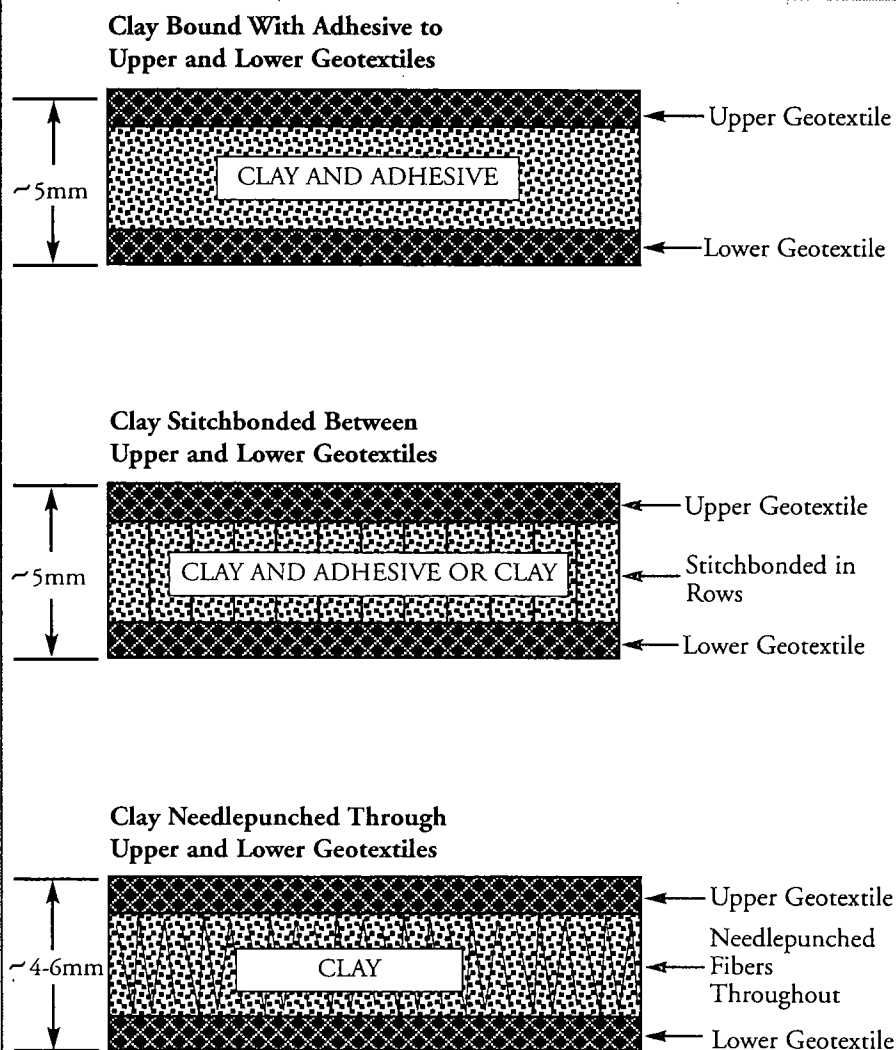
### Product Types

The following types of GCL products are currently available:

#### ■ Geotextile type:

- Bentofix® (activated sodium bentonite as primary ingredient and affixed by needlepunching to a woven or nonwoven upper geotextile and a nonwoven lower geotextile).
- Bentomat® (sodium bentonite as primary ingredient and affixed by needlepunching to a

**Figure 2. Affixing Bentonite to Geotextiles**



woven or nonwoven upper geotextile and a nonwoven lower geotextile).

- Claymax® (sodium bentonite as primary ingredient mixed with water-soluble adhesive and bonded or stitchbonded to a woven upper and lower geotextile).

#### ■ Geomembrane type:

- Gundseal® (sodium bentonite as the primary ingredient mixed with an adhesive and bonded to a blend

of high density polyethylene and very low density polyethylene).

Table 1 lists information on variations of these product types by manufacturer, and Figure 3 presents cross-section views of these product configurations.

In general, manufacturers ship GCL products in rolled sheets ranging from 13 to 18 feet wide and from 100 to 200 feet long. GCLs range in thickness from 0.2 to 0.3 inches.

**Table 1. Principal GCL Products Available in the United States**

Manufacturer & Product Name	Upper Geosynthetic <sup>a</sup>	Lower Geosynthetic <sup>a</sup>	Bonding Method	Standard Roll Width x Length (feet)
<b>Fluid Systems, Inc. (FSI) (Germany)</b>				
Bentofix NS	woven	nonwoven	needlepunched	(15.2 x 100)
Bentofix WP	woven	nonwoven	needlepunched	(15.2 x 100)
Bentofix NW	nonwoven <sup>b</sup>	nonwoven	needlepunched	(15.2 x 100)
<b>Colloid Environmental Technologies Company (CETCO) (United States)</b>				
Claymax 200R	woven	woven	adhered	(13.83 x 150)
Claymax 500SP	woven	woven	adhered and stitchbonded	(13.83 x 150)
Claymax 506SP	woven	woven	adhered and stitchbonded	(13.83 x 150)
Bentomat "ST"	woven	nonwoven	needlepunched	(15.3 x 125)
Bentomat "N"	nonwoven	nonwoven	needlepunched	(15.3 x 125)
<b>GSE Environmental (United States)<sup>c</sup></b>				
Gundseal HD 20	none <sup>d</sup>	HDPE <sup>e</sup>	adhered	(17.5 x 200)
Gundseal HD 30	none <sup>d</sup>	HDPE	adhered	(17.5 x 200)
Gundseal HD 30	none <sup>d</sup>	HDPE/VLDPE <sup>f</sup>	adhered	(17.5 x 200)
Gundseal HD 60	none <sup>d</sup>	HDPE/VLDPE	adhered	(17.5 x 170)
Gundseal HD 80	none <sup>d</sup>	HDPE/VLDPE	adhered	(17.5 x 150)
Gundseal HD 40	none <sup>d</sup>	textured HDPE	adhered	(17.5 x 200)
Gundseal HD 60	none <sup>d</sup>	textured HDPE	adhered	(17.5 x 200)
Gundseal HD 80	none <sup>d</sup>	textured HDPE	adhered	(17.5 x 200)

<sup>a</sup> These properties vary by product and application.

<sup>b</sup> Nonwoven layer is scrim (a woven, open-mesh reinforcing fabric made from continuous-filament yarn) reinforced.

<sup>c</sup> All Gundseal products can be manufactured in 8-foot widths and with leachate-resistant bentonite. Products with backings that are 40 mils or greater can be manufactured with VLDPE as the lower geosynthetic material.

<sup>d</sup> Can be manufactured with a nonwoven, 0.75-ounce-per-square-yard geotextile as the upper geosynthetic material.

<sup>e</sup> High density polyethylene.

<sup>f</sup> Very low density polyethylene.

## Installation

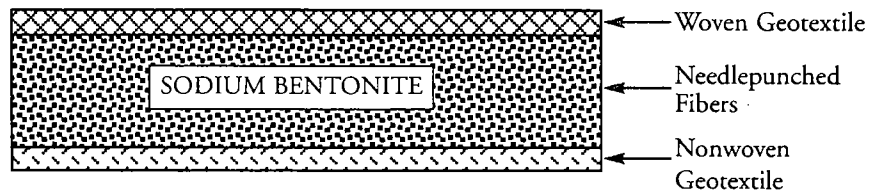
Landfill operators can install all available GCL products much faster and more easily than compacted clay liners. Unlike compacted clay liners, however, GCLs are more susceptible to damage during transport and installation. Care should be taken during and after installation to avoid hydration. Hydration results in unconfined swelling of the bentonite and causes the geotextile layers to pull apart, undermining the integrity of the GCL configuration.

Manufacturers usually specify individual GCL installation procedures. Basic procedures, however, call for rolling out the large GCL sheets onto the site subgrade, which should be smooth (e.g., free of stones and grade stakes), well compacted, and dry. Once installers cover the GCL with soil, the GCL hydrates by drawing moisture from the soil. As a result, when laying out the GCL, installers must allow enough seam overlap at adjoining sheets to guard against the potential opening of the barrier system. Currently, the recommended amount of seam overlap and other seaming considerations vary with the particular GCL product. Thus, installers should follow the manufacturer's instructions for the particular product.

GCL manufacturers, and some private engineering firms, provide training for GCL installers. Among other considerations, instructions typically emphasize techniques for minimizing potential damage to the GCL during installation. The National Institute for Certification of Engineering Technologists in Alexandria, Virginia, offers a certification program in quality assurance and quality control inspection of GCL installations.

Figure 3. Available GCL Products

### Bentofix and Bentomat



### Claymax 200R



### Claymax 500SP



### Gundseal



## Costs

As of 1994, the cost of an installed GCL ranged from \$0.42 to \$0.60 per square foot. Factors affecting the cost of a GCL include:

- Shipping distance
- Size of the job

- Market demand
- Time of the year

In general, GCL barrier systems are especially cost-effective in areas where clay is not readily available for use as a liner material.

## Issues To Be Addressed

This emerging technology requires additional field and laboratory testing to further assess its effectiveness as a landfill barrier system in terms of the key performance factors discussed below. Improved product design and installation standards must also be established.

### Performance Factors

Further research is needed into the following key performance factors of GCLs:

#### Hydraulic Conductivity

Available data on the hydraulic conductivity of various GCL configurations are gathered exclusively under laboratory conditions. Data from field tests should be collected to establish product design values.

#### Bearing Capacity

A study by the Geosynthetic Research Institute provides the basis for allaying some concerns about the bearing capacity of hydrated GCLs, but more research is needed. The study demonstrated that an adequate layer of cover soil (according to the product manufacturers' recommendations), placed on GCLs during installation, prevents a decrease in liner thickness with the application of a load. Without a sufficient soil layer, GCLs become compressed, raising their hydraulic conductivity (i.e., making them more permeable) and reducing their effectiveness as a barrier.

#### Slope Stability

Research is ongoing on the slope stability of GCLs used in landfill sidewall applications to determine whether this use of GCLs provides sufficient resistance to internal shear and physical displacement. Additional data are needed to support the preliminary results of a U.S. Environmental Protection Agency field study indicating good stability of GCL technology following capping operations. This study mimicked the construction stresses all four GCL products (see Figure 3) are subjected to during capping. Constructed in November 1994, the study site used five plots of GCL placed at a 3 to 1 slope and eight plots placed at a 2 to 1 slope. All plots had a 3-foot-thick soil cap. Researchers collected information on the soil and clay moisture of the GCL using internal probes, and they measured the GCL for physical displacement. Results to date indicate good slope stability for all plots.

#### Long-Term Reliability

The geotextile or geomembrane in GCL products remains durable for long periods of time.

#### Freeze and Thaw Cycles

Freeze and thaw cycles do not affect GCLs used in landfill bottom liner applications because these systems are installed below the frost line. Limited laboratory data indicate that the hydraulic conductivity of GCLs is not affected by freeze and thaw cycles. Laboratory tests performed on a bentonitic blanket indicate that hydraulic conductivity before freezing of  $2 \times 10^{-11}$  cm/sec was unaltered after five freeze and thaw cycles. Full-scale field tests still must be conducted, however, to corroborate the laboratory data, especially for GCL technology used as an infiltration barrier in landfill caps.

## Design and Installation Standards

The following issues must be addressed to encourage the further development of GCL technology as a landfill barrier system:

### Material Properties and Additional Testing Methods

To allow design engineers to develop more precise site specifications, a list of important performance properties for materials used in GCL products, as well as minimum performance values, must be established. Additional testing procedures must be developed, and all methods should be standardized to facilitate the realistic comparison of different GCL products.

### Construction and Installation Procedures

Standardized practices must be developed to address GCLs' vulnerability to the following:

- System stress from inclement weather after installation.
- Potential for lack of hydration of bentonite clay in arid regions.
- Punctures in the barrier system (reducing the barrier potential of both the clay and the geosynthetics).
- System decay caused by biological intruders, such as burrowing animals and tree roots (potentially affecting both the clay and the geosynthetics).

Additionally, a standardized quality assurance and quality control program must be developed.

## Case Studies

The following case studies illustrate some of the uses of GCL technology as a barrier system in landfills. Currently available information from these sites relates to installation only; long-term performance is still being assessed. Only one of the studies concerns the use of GCL technology in bottom liner applications, because this use is relatively new. The other two studies focus on cap system applications, which represent a slightly more established use of the technology. The case studies represent sites in three different geographic regions and involve three different GCL products.

### **GCL Landfill Liner: Broad Acre Landfill Pueblo, Colorado**

Broad Acre Landfill installed a liner system in 1991 that included:

- ▣ A 60-mil Gundseal GCL
- ▣ 1 foot of compacted clay

According to landfill operators, the Gundseal was easy to work with. They installed 200,000 square feet in 1 week. Workers installed the liner with the bentonite side down (i.e., the geomembrane side up). As of February 1996, landfill officials reported that the liner was functioning effectively. No releases of leachate have been detected by the ground-water monitoring system.

### **GCL Landfill Cap: Whyco Chromium Landfill Thomaston, Connecticut**

During July 1989, Whyco Chromium Landfill installed a Claymax 200R GCL in a cap system that included the following (from top to bottom):

- ▣ 6 inches of topsoil
- ▣ 24 inches of earthen material
- ▣ Geogrid (for tensile strength)
- ▣ Geotextile
- ▣ Polyvinyl chloride geomembrane (30-mil thickness)
- ▣ Claymax
- ▣ Geotextile

The landfill site occupies 41,000 square feet, and workers installed the Claymax product in 1 day. Thus far, the cap is functioning well.

### **GCL Landfill Cap: Enoree Landfill Greenville, South Carolina**

In August 1994, the first phase of closure at the Enoree Landfill involved installing the following cap system:

- ▣ 6 to 12 inches of new and native soil
- ▣ 18 inches of compacted clay
- ▣ Bentofix GCL

Enoree staff capped approximately 26 acres of the landfill in 6 weeks. Landfill officials report that the cap is functioning effectively.

The mention of publications, products, or organizations in this fact sheet does not constitute or imply endorsement or approval for use by the U.S. Environmental Protection Agency.

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## Bentomat® CL Certified Properties

Bentomat "CL" is a reinforced GCL consisting of a layer of sodium bentonite between two geotextiles, which are needlepunched together and laminated to a thin flexible membrane liner.

MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY, ft <sup>2</sup> (m <sup>2</sup> )	CERTIFIED VALUES
Bentonite Swell Index <sup>1</sup>	ASTM D 5890	1 per 50 tons	24 mL/2g min.
Bentonite Fluid Loss <sup>1</sup>	ASTM D 5891	1 per 50 tons	18 mL max.
Bentonite Mass/Area <sup>2</sup>	ASTM D 5993	40,000 ft <sup>2</sup> (4,000 m <sup>2</sup> )	0.75 lb/ft <sup>2</sup> (3.6 kg/m <sup>2</sup> )
GCL Grab Strength <sup>3</sup>	ASTM D 4632	200,000 ft <sup>2</sup> (20,000 m <sup>2</sup> )	120 lbs (530 N)
GCL Peel Strength <sup>3</sup>	ASTM D 4632	40,000 ft <sup>2</sup> (4,000 m <sup>2</sup> )	15 lbs (65 N)
GCL Index Flux <sup>4</sup>	ASTM D 5887 or E 96	Weekly	1 x 10 <sup>-9</sup> m <sup>3</sup> /m <sup>2</sup> /sec
GCL Hydraulic Conductivity <sup>4</sup>	ASTM D 5084 or E 96	Weekly	5 x 10 <sup>-10</sup> cm/sec
GCL Hydrated Internal Shear Strength <sup>5</sup>	ASTM D 5321	Periodic	500 psf (24 kPa) typical

**Notes:**

- <sup>1</sup> Bentonite property tests performed at CETCO's bentonite processing facility before shipment to CETCO's GCL production facilities.
- <sup>2</sup> Bentonite mass/area reported at 0 percent moisture content.
- <sup>3</sup> All tensile testing is performed in the machine direction, with results as minimum average roll values unless otherwise indicated.
- <sup>4</sup> ASTM D5887 Index flux and ASTM D5084 hydraulic conductivity testing with deaired distilled/deionized water at 80 psi (551 kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure. Reported value is equivalent to 95 gal/acre/day. This flux value is equivalent to a permeability of 5x10<sup>-10</sup> cm/sec for typical GCL thickness. Alternatively, hydraulic conductivity can be determined by performing water vapor transmissivity testing (ASTM E 96) on the membrane side of the GCL and use conversion outlined by Koerner (1994). This flux value should not be used for equivalency calculations unless the gradients used represent field conditions. A flux test using gradients that represent field conditions must be performed to determine equivalency. The last 20 weekly values prior the end of the production date of the supplied GCL may be provided.
- <sup>5</sup> Peak value measured at 200 psf (10 kPa) normal stress. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.



## TECHNICAL NOTE

### Permeability for GSE Geomembranes

Due to its chemical structure, polyethylene is an (essentially) impermeable substance. The material is made up of very long molecules. There does exist, however, molecular voids (sometimes referred to as "free space") among the individual polyethylene chains. The existence of these spaces is recognized when we say polyethylene is essentially impermeable. Permeation may exist when, for instance, the pressure behind the permeant is very high or the permeant's molecular size is very small. However, the degree of permeation exhibited is difficult to determine using currently available test procedures. As a result, test results frequently reflect the inaccuracy of the procedure rather than the permeation of the material. Testing of GSE HDPE performed by an independent laboratory produced the following results.

Test	ASTM Method	Results
Methane Permeability	D 1434	$2.0 \times 10^{-6} \text{ ml/cm}^2\text{s}$
Water Vapor Permeability	E 96	$1.7 \times 10^{-9} \text{ ml/cm}^2\text{s}$

It must be emphasized that different chemicals will permeate at different rates due to differences in molecular shape, polarity and phase (gas or liquid). For example, the relatively small water molecule (atomic weight 18) will more easily permeate the polyethylene matrix as compared to a large molecule such as cyclohexanol (atomic weight 94).

The molecules' polarity must also be considered (recall the adage "like dissolves like"). Polyethylene is a non-polar molecule, therefore other non-polar molecules will permeate the matrix better. Examples of these molecules are hydrocarbons - especially those such as octane, pentane and hexene. The permeation of these are therefore greater than for polar molecules such as water.

A sometimes overlooked factor when reviewing permeation data is that most permeameters apply pressure to encourage permeation. In geotechnical and environmental applications, geomembranes are not subjected to the high pressures of potential permeants as they are in a permeation laboratory test. The lack of a driving force greatly diminishes actual permeation since the gaseous molecules find an easier path to follow than through the polyethylene liner. Also, because of the high pressures required to force permeants through polyethylene, failure of the permeameter is common. This is commonly in the form of a test apparatus leak. Such leaks can result in erroneous results.

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Permeability

**APPENDIX B**  
**GCL INFORMATION**



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**m e m o r a n d u m**

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to: Scott Jordan, Craig Skiera

from: Tom Cole

re: Purity Oil Sales Site: GCL Compatibility with Neutralized Sludge Material

date: January 19, 2004

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Due to the nature of the remedial activities at the Purity Oil Sales Site in Fresno, California, concern has been raised regarding the compatibility of the Geosynthetic Clay Liner (GCL) with the neutralized sludge layer material. This memorandum assesses the potential for physical and chemical interaction between the GCL and the neutralized material and evaluates the impact that such interaction may have on performance criteria.

**Overview of Remedial Activities**

The waste layer being neutralized at the Site consists of acidic petroleum sludge, soils, and various amounts of nested debris. During neutralization activities, the sludge layer is excavated, screened to remove large debris, and mixed with calcium carbonate and native soil. This process creates a more homogenous soil mixture that exhibits improved strength characteristics and pH levels. Once the neutralized material is verified to have a pH between 5 and 8, the material is compacted in 12-inch lifts to a minimum density of 107 pcf.

When neutralization activities have been completed, the neutralized waste layer will be graded appropriately and a 6-inch subgrade layer will be compacted to 90% of its maximum dry density as determined by ASTM D 698. The subgrade may be composed of neutralized material, non-impacted Site soils, or imported soil, as appropriate. When the subgrade is complete, another 6-inch cushion layer of imported clean soil will be compacted to 90% of its maximum dry density, as determined by ASTM D 698. The cushion layer will serve as separation between the GCL and the neutralized material.

When compaction of the subgrade and cushion layers has been completed and verified, the stitch-bonded or needle-punched GCL will be placed and an additional 24 inches of non-impacted soil will be placed on top of the GCL. The surface of the cap will be seeded and protected from erosion until vegetative growth is established.

**Compatibility Concerns**

The compatibility concern between the GCL and the neutralized material centers around the potential for degradation of performance as a result of ion exchange reactions. GCLs are comprised of two layers of synthetic geotextile sandwiched around a layer of bentonite. The bentonite swells when it comes into contact with water, producing a self-sealing layer of very low hydraulic conductivity. The following discussion references the attached abstract from a paper published by T. A. Egloffstein in the 2002 issue of Clay Geosynthetic Barriers, Swets & Zettlinger.

Bentonite is predominantly composed the negatively charged clay mineral, montmorillinite, and positively charged metal ions such as sodium, calcium, magnesium, and potassium. Although calcium bentonite is the most common naturally occurring deposit, sodium bentonite produces the most effective water barrier. The monovalent sodium ions cluster around the individual mineral platelets, creating a diffuse double layer that hinders hydraulic conductivity. In calcium bentonite and other divalent-metal bentonites, the ions also create hydrated "clouds" around mineral particles, however the double positive charge requires only half as many divalent ions to



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neutralize the negative charge on the mineral. The fewer number of ions produces smaller hydrated clouds, thus decreasing swell capacity and increasing hydraulic conductivity. For this reason, the bentonite used in most commercial GCLs is treated with sodium bicarbonate to exchange calcium ions with sodium ions, producing a more effective product. However, this treatment is short-lived when subjected to field application conditions.

Almost all cover materials used during construction of a low permeability cap contain significantly more calcium than sodium. Due to montmorillinite's preferential cation exchange capacity for divalent cations and the relative abundance of calcium in natural soil deposits, sodium bentonite GCLs placed in the field undergo ion exchange reactions that gradually replace sodium ions with calcium ions. Field experience indicates that complete ion exchange of the sodium ions takes place within a few years of construction. This transformation from sodium to calcium bentonite occurs at nearly all field applications of GCLs, even in the absence of neutralization agents.

Due to this ion exchange process, concern has been expressed that field performance of the GCL will deteriorate to the point that it no longer meets the performance objectives of the Remedial Action Plan.

### **Assessment of Performance Criteria**

The intention of the low permeability cap material is to minimize infiltration of precipitation into the waste layer. Typical cap construction specifications call for 12 inches of compacted soil with a hydraulic conductivity of  $1 \times 10^{-6}$  cm/sec or an equivalent hydraulic flow-through system. Typical hydraulic conductivities for sodium montmorillinite are on the order of  $1 \times 10^{-9}$  cm/sec, approximately three orders of magnitude below the referenced specification. A material that exhibits these properties could meet the hydraulic flow-through specification with a thickness of approximately one hundredth of an inch under ideal circumstances.

However, GCLs placed in the field exhibit higher hydraulic conductivity properties after undergoing ion exchange reactions. Laboratory tests and field investigations indicate that the effective hydraulic conductivity of calcium bentonite is approximately half an order of magnitude greater than that of sodium bentonite. The final effective hydraulic conductivity for calcium-exchanged GCLs generally ranges from  $5 \times 10^{-9}$  to  $1 \times 10^{-8}$  cm/sec. The worst-case hydraulic conductivity for this material would require a thickness of approximately one tenth of an inch to meet the hydraulic flow-through specification. Most commercial GCLs are approximately 1/4-inch thick, providing a factor of safety of approximately 2.5 against infiltration. Therefore, a sodium montmorillinite GCL will eventually convert to calcium montmorillinite, whether or not it contacts neutralized material, however, it will still retain the required low hydraulic conductivity properties necessary for the closure cover system.

Contact with neutralization agents should not cause additional concern due to the placement of the six-inch cushion layer. This material will provide significant separation between neutralized material and the GCL. Even if contact were to occur, no ill effects would be anticipated. As outlined in the attached letter written by William Urchick of CETCO, manufacturer guidelines for installation of the GCL include placement and compaction of a 6-inch cushion layer and coverage with at least 24 inches of water-retaining soil (clay to silty material). Both of these criteria are met in the RAP.



Attn: Tom Cole  
Re: GCL - Purity Oil Sales Cap  
Date: October 23, 2002  
From: William Urchik

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Dear Tom,

Please accept this memo as a follow up to our conversation a few days ago regarding the Purity Oil Sales cap and the possibility of using a GCL to cap this site.

Apparently the EPA is concerned about cation exchange in the GCL and has discussed the possibility of using a calcium bentonite in the GCL for this project. However, CETCO does not recommend using a calcium bentonite as a GCL with calcium bentonite would not meet the hydraulic conductivity requirements for this project. To address the issue of ion exchange in a GCL, I have attached a research paper presented at the GCL conference in Germany this past year. This paper makes a number of recommendations when utilizing a GCL in a capping orientation to guard against cation exchange and the performance expected if cation exchange does occur. A brief summary of these recommendations is given below:

- Cover the GCL with a minimum 2 feet of soil with a high water capacity storage. (ie. clay and silty soil)
- Place 6 inches of soil between waste and GCL, especially if subgrade soil is amended with lime.

By using the above recommendations in the design of this cap, the expected degradation in the GCL due to ion exchange would be expected to be 1/2 order of magnitude increase in hydraulic conductivity. This performance is supported with the Egloffstein paper, which is attached for your review.

**Title: Bentonite as Sealing Material in Geosynthetic Clay Liners - Influence of the Electrolytic Concentration, the Ion Exchange and Ion Exchange with Simultaneous Partial Desiccation on Permeability**  
**Written by: T.A. Egloffstein**

Geosynthetic clay liners (GCLs) are sealing layers, which usually contain natural sodium bentonite as a effective sealing element, which is encapsulated between geotextile components. They are used in a variety of sealing applications, predominantly in hydraulic engineering and groundwater protection. They are most commonly employed to replace compacted clay liners (CCLs). In contact with water, bentonites swell and thereby close their pore spaces, which accounts for their low permeability. This extreme swelling requires water with a low content of electrolytes. Contact with chemicals in leachates and other solutions can lower the swelling of a GCL and thereby lead to a higher permeability. Commonly GCLs are covered with soil to create counter pressure against the swelling process in order to receive a denser structure with low hydraulic permeability. Besides this, the soil cover protects the GCL against damaging. In this geo-chemical environment an ion exchange of sodium-bentonite to calcium-bentonite occurs due to two reasons. Firstly calcium is often predominating, secondly bivalent  $\text{Ca}^{2+}$  is more easily exchanged against monovalent sodium ( $\text{Na}^{+}$ ) than vice versa. This exchange typically takes place over a period of several months to a few years, if in contact with cover-soil seepage. The ion exchange effects an increase in hydraulic conductivity of approximately  $\frac{1}{2}$  to 1 decimal exponent. This is however not alarming, as long as planning engineers take this effect into consideration. Landfill capping systems as well as sealings along highways through water protection areas are characterized by unsaturated conditions, as often found in applications with low confining stress ( $< 15 \text{ kN/m}^2$ , less than 0.75 m soil-cover). In such cases, GCLs tend to show desiccation cracks, which cause a significant increase in permeability. In contrast to compacted clay liners, where self sealing is unlikely to occur due to low confining stress, a self sealing of calcium-bentonite GCLs takes place by swelling and plastification of bentonite, if a soil-cover of more than 0.75, better 1.0 m (equals a confining stress of  $15 - 20 \text{ kN/m}^2$ ) is provided.

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**TITLE 22. Social Security****Division 4.5. Environmental Health Standards for the Management of Hazardous Waste****Chapter 14. Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities****Article 6. Water Quality Monitoring and Response Programs for Permitted Facilities****§66264.90. Applicability.****§66264.90. Applicability.**• [Note](#) • [History](#)

(a) The regulations in this article apply to owners or operators of permitted hazardous waste facilities. A surface impoundment, waste pile, land treatment unit or landfill that receives or has received hazardous waste after July 26, 1982 shall comply with the requirements of this article for purposes of detecting, characterizing, and responding to releases to groundwater, surface water or the unsaturated zone. The Department shall require an owner or operator of a surface impoundment, waste pile, land treatment unit or landfill that ceased receiving hazardous waste by July 26, 1982 to comply with the requirements of this article if the Department determines that constituents in or derived from waste placed in the surface impoundment, waste pile, land treatment unit or landfill may pose a threat to human health or the environment. A surface impoundment, waste pile, land treatment unit or landfill required to comply with the provisions of this article is hereinafter referred to as a "regulated unit."

(b) The facility permit shall contain assurances of financial responsibility for completing corrective action for all releases from any regulated unit at the facility.

(c) The regulations under this article apply during the active life of the regulated unit (including the closure period). After closure of the regulated unit, the regulations in this article apply during the postclosure care period under [section 66264.117](#) of article 7 of this chapter and during any compliance period under [section 66264.96](#) unless:

(1) the regulated unit has been in compliance with the water quality protection standard for a period of three consecutive years; and

(2) all waste, waste residues, contaminated containment system components, contaminated subsoils and all other contaminated geologic materials are removed or decontaminated at closure.

(d) Regulations in this article apply to miscellaneous units when necessary to comply with [sections 66264.601 through 66264.603](#) of article 16 of this chapter.

(e) For all regulated units which are operating, have operated or have received all permits necessary for construction or operation on or before July 1, 1991, the owner or operator shall prepare an application for a permit modification pursuant to chapter 21 of this division to establish monitoring programs that comply with the provisions of this article and submit this application to the Department within 180 days of July 1, 1991. The owner or operator of such regulated units shall begin any necessary construction within 30 days of receiving approval from the Department and shall implement the approved monitoring programs according to a schedule of compliance established by the Department.

**NOTE**

Authority cited: Sections 208, 25150 and 25159, Health and Safety Code. Reference: Sections 25150, 25159 and 25159.5, Health and Safety Code; 40 CFR Section 264.90.

**HISTORY**

1. New section filed 5-24-91; effective 7-1-91 (Register 91, No. 22).

**§66264.91. Required Programs.**• [Note](#) • [History](#)

(a) An owner or operator subject to this article shall conduct a monitoring and response program for each regulated unit at the facility as follows:

(1) the owner or operator shall institute a detection monitoring program under [section 66264.98](#) except as required under subsections (a)(2), (a)(3) and (a)(4) of this section;

(2) the owner or operator shall institute an evaluation monitoring program under [section 66264.99](#) whenever there is statistically significant evidence of a release, pursuant to [section 66264.98\(g\)](#) or (i), from the regulated unit during a detection monitoring program;

(3) the owner or operator shall institute an evaluation monitoring program under [section 66264.99](#) whenever there is significant physical evidence of a release from the regulated unit. Significant physical evidence of a release includes unexplained volumetric changes in surface impoundments, unexplained stress in biological communities, unexplained changes in soil coloration, visible signs of leachate migration, unexplained water table mounding beneath or adjacent to the regulated unit, and any other change to the environment that could reasonably be expected to be the result of a release from the regulated unit; and

(4) the owner or operator shall institute a corrective action program under [section 66264.100](#) when the Department determines pursuant to [section 66264.99](#) that the assessment of the nature and extent of the release and the design of the corrective action program have been satisfactorily completed and the Department approves the application for a permit modification for corrective action submitted by the owner or operator during an evaluation monitoring program pursuant to [section 66264.99\(d\)](#) or [section 66265.99\(d\)](#).

(b) The Department shall specify in the facility permit the specific elements of each monitoring and response program. For each regulated unit, the Department shall include one or more of the programs identified in subsection (a) of this section in the facility permit as may be necessary to protect human health or the environment and shall specify the circumstances under which each of the programs will be required. In deciding whether to require the owner or operator to be prepared to institute a particular program, the Department shall consider the potential adverse effects on human health or the environment that might occur before final administrative action on a permit modification application to incorporate such a program could be taken.

(c) In conjunction with an evaluation monitoring program or a corrective action program, the owner or operator shall continue to conduct a detection monitoring program under [section 66264.98](#) as necessary to provide the best assurance of the detection of subsequent releases from the regulated unit.



**TITLE 22. Social Security****Division 4.5. Environmental Health Standards for the Management of Hazardous Waste****Chapter 15. Interim Status Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal****Article 6. Water Quality Monitoring and Response Programs for Interim Status Facilities****§66265.90. Applicability.****§66265.90. Applicability.**• [Note](#) • [History](#)

(a) The regulations in this article apply to owners or operators of facilities specified in [section 66265.1\(b\)](#). A surface impoundment, waste pile, land treatment unit or landfill that receives or has received hazardous waste after November 19, 1980 shall comply with the requirements of this article for purposes of detecting, characterizing and responding to releases to groundwater, surface water or the unsaturated zone. The Department shall require an owner or operator of a surface impoundment, waste pile, land treatment unit or landfill that ceased receiving hazardous waste by November 19, 1980 to comply with the requirements of this article if the Department determines that constituents in or derived from waste placed in the surface impoundment, waste pile, land treatment unit or landfill may pose a threat to human health or the environment. A surface impoundment, waste pile, land treatment unit or landfill required to comply with the provisions of this article is hereinafter referred to as a "regulated unit."

**NOTE**

Authority cited: Sections 208, 25150 and 25159, Health and Safety Code. Reference: Sections 25150, 25150.5 and 25159, Health and Safety Code.

**HISTORY**

1. New section filed 5-24-91; operative 7-1-91 (Register 91, No. 22).

**§66265.91. Required Programs and the Water Quality Sampling and Analysis Plan.**• [Note](#) • [History](#)

(a) An owner or operator subject to this article shall conduct a monitoring and response program for each regulated unit at the facility as follows:

(1) the owner or operator shall institute a detection monitoring program under [section 66265.98](#) except as required under subsections (a)(2) and (a)(3) of this section;

(2) the owner or operator shall institute an evaluation monitoring program under [section 66265.99](#) whenever there is statistically significant evidence of a release, pursuant to [section 66265.98\(g\)](#) or (i) from the regulated unit during a detection monitoring program; and

(3) the owner or operator shall institute an evaluation monitoring program under [section 66265.99](#) whenever there is significant physical evidence of a release from the regulated unit. Significant physical evidence of a release includes unexplained volumetric changes in surface impoundments, unexplained stress in biological communities, unexplained changes in soil coloration, visible signs of leachate migration, unexplained water table mounding beneath or adjacent to the regulated unit and any other change to the environment that could reasonably be expected to be the result of a release from the regulated unit.

(b) The owner or operator shall develop and follow a water quality sampling and analysis plan that satisfies the

requirements of this article. The owner or operator shall submit this plan to the Department and initiate institute a water quality monitoring program required by subsection (a) of this section within 180 days of July 1, 1991. Until the water quality monitoring program is in full operation, the owner or operator shall continue to monitor in accordance with 40 CFR Part 265, Subpart F. The owner or operator shall submit all modifications to the water quality sampling and analysis plan to the Department and shall maintain a current version of the water quality sampling and analysis plan in the operating record at the facility. The Department shall require the owner or operator to modify the water quality sampling and analysis plan as necessary to protect human health or the environment.

(c) The owner or operator shall specify in the water quality sampling and analysis plan the specific elements of each monitoring and response program. For each regulated unit, the owner or operator shall include in the water quality sampling and analysis plan one or more of the programs identified in subsection (a) of this section as may be necessary to protect human health or the environment and shall specify the circumstances under which each of the programs will be required.

(d) In conjunction with an evaluation monitoring program the owner or operator shall continue to conduct a detection monitoring program under section 66265.98 as necessary to provide the best assurance of the detection of subsequent releases from the regulated unit.

#### NOTE

Authority cited: Sections 208, 25150 and 25259, Health and Safety Code. Reference: Sections 25150, 25150.5 and 25159, Health and Safety Code.



TITLE 22. Social Security

Division 4.5. Environmental Health Standards for the Management of Hazardous Waste

Chapter 14. Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities

Article 7. Closure and Post-Closure

§66264.111. Closure Performance Standard.

The owner or operator shall close the facility in a manner that:

- (a) minimizes the need for further maintenance; and
- (b) controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, possible closure escape of hazardous waste, hazardous constituents, leachate, contaminated rainfall or run-off, or waste decomposition products to the ground or surface waters or to the atmosphere; and
- (c) complies with the closure requirements of this chapter including, but not limited to, the requirements of sections 66264.178, 66264.197, 66264.228, 66264.258, 66264.280, **66264.310**, 66264.351, 66264.601 through 66264.603, and 66264.1102.

NOTE

Authority cited: Sections 25150, 25159, 25159.5, 25179.6, 25245 and 58012, Health and Safety Code. Reference: Sections 25159, 25159.5, 25245 and 58012, Health and Safety Code; 40 CFR Section 264.111.

HISTORY

1. New section filed 5-24-91; effective 7-1-91 (Register 91, No. 22).
2. Amendment of subsection (c) and Note filed 10-24-94 as an emergency; operative 10-24-94 (Register 94, No. 43). A Certificate of Compliance must be transmitted to OAL by 2-20-95 or emergency language will be repealed by operation of law on the following day.
3. Amendment of subsection (c) and Note refiled 2-21-95 as an emergency; operative 2-21-95 (Register 95, No. 8). A Certificate of Compliance must be transmitted to OAL by 6-21-95 or emergency language will be repealed by operation of law on the following day.
4. Amendment of subsection (c) and Note refiled 6-19-95 as an emergency; operative 6-19-95 (Register 95, No. 25). A Certificate of Compliance must be transmitted to OAL by 10-17-95 or emergency language will be repealed by operation of law on the following day.
5. Amendment of subsection (c) and Note refiled 10-16-95 as an emergency; operative 10-16-95 (Register 95, No. 42). A Certificate of Compliance must be transmitted to OAL by 2-13-96 or emergency language will be repealed by operation of law on the following day.
6. Certificate of Compliance as to 10-24-94 order transmitted to OAL 12-15-95 and filed 1-31-96 (Register 96, No. 5).

§66264.112. Closure Plan; Amendment of Plan.

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Note

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History

- (a) Written plan.
- (1) The owner or operator of a hazardous waste management facility shall have a written closure plan. In addition, certain surface impoundments and waste piles from which the owner or operator intends to re--move or decontaminate the hazardous waste at partial or final closure are required by sections 66264.228(c)(1)(A) and 66264.258(c)(1)(A) to have contingent closure plans. The plan shall be submitted with the permit application, in accordance with section 66270.14(b)(13) of this division, or when otherwise requested by the Department. The plan shall be approved by the Department as part of the permit issuance procedures under Chapter 21 of this division. In accordance with section 66270.32 of this division, the approved closure plan will become a condition of any permit.

(2) The Department's approval of the plan shall ensure that the approved closure plan is consistent with sections 66264.111 through 66264.115 and the applicable requirements of article 6 of this chapter and sections 66264.178, 66264.197, 66264.228, 66264.258, 66264.280, 66264.310, 66264.351, 66264.601 and 66264.1102. Until final closure is completed and certified in accordance with section 66264.115, a copy of the approved plan and all approved revisions shall be kept at the facility and furnished to the Department upon request, including request by mail.

(b) Content of plan. The plan shall identify steps necessary to perform partial or final closure of the facility at any point during its active life and to perform final closure of the facility at the end of its active life. The closure plan shall include, at least:

(1) a description of how and when each hazardous waste management unit at the facility will be closed in accordance with section 66264.111;

(2) a description of how and when final closure of the facility will be conducted in accordance with section 66264.111. The description shall identify the maximum extent of the operations which will be unclosed during the active life of the facility;

(3) an estimate of the maximum inventory of hazardous wastes ever on-site over the active life of the facility and a detailed description of the methods to be used during partial closures and final closure, including, but not limited to, methods for removing, transporting, treating, storing, or disposing of all hazardous wastes, and identification of the type(s) of the off-site hazardous waste management units to be used, if applicable;

(4) a detailed description of the steps needed to remove or decontaminate all hazardous waste residues and contaminated containment system components, equipment, structures, and soils during partial and final closure, including, but not limited to, procedures for cleaning equipment and removing contaminated soils, methods for sampling and testing surrounding soils, and criteria for determining the extent of decontamination required to satisfy the closure performance standard;

(5) a detailed description of other activities necessary during the closure period to ensure that all partial closures and final closure satisfy the closure performance standards, including, but not limited to, ground-water monitoring, leachate collection, and run-on and run-off control;

(6) a schedule for closure of each hazardous waste management unit and for final closure of the facility. The schedule shall include, at a minimum, the total time required to close each hazardous waste management unit and the time required for intervening closure activities which will allow tracking of the progress of partial and final closure. (For example, in the case of a landfill unit, estimates of the time required to treat or dispose of all hazardous waste inventory and of the time required to place a final cover shall be included);

(7) an estimate of the expected year of final closure.

(c) Amendment of plan. The owner or operator shall submit a written notification of or request for a permit modification to authorize a change in the approved closure plan in accordance with the applicable procedures in chapters 20 and 21 of this division. The written notification request shall include a copy of the amended closure plan for review or approval by the Department.

(1) The owner or operator may submit a written notification or request to the Department for a permit modification to amend the closure plan at any time prior to the notification of partial or final closure of the facility.

(2) The owner or operator shall submit a written notification or request for a permit modification to authorize a change in the approved closure plan whenever:

(A) changes in operating plans or facility design affect the closure plan, or

(B) there is a change in the expected year of closure, or

(C) in conducting partial or final closure activities, unexpected events require a modification of the approved closure plan.

(3) The owner or operator shall submit a written request for a permit modification including a copy of the amended closure plan for approval at least 60 days prior to the proposed change in facility design or operation, or

no later than 60 days after an unexpected event has occurred which has affected the closure plan. If an unexpected event occurs during the partial or final closure period, the owner or operator shall request a permit modification no later than 30 days after the unexpected event. The Department will approve, disapprove, or modify this amended plan in accordance with the procedures in chapters 20 and 21 of this division. In accordance with section 66270.32 of this division, the approved closure plan will become a condition of any permit issued.

(4) The Department may request modifications to the plan under the conditions described in section 66264.112(c)

(2). The owner or operator shall submit the modified plan within 60 days of the Department's request, or within 30 days if the change in facility conditions occurs during partial or final closure. Any modifications requested by the Department will be approved in accordance with the procedures in chapters 20 and 21 of this division.

(d) Notification of partial closure and final closure.

(1) The owner or operator shall notify the Department in writing at least 60 days prior to the date on which the owner or operator expects to begin closure of a surface impoundment, waste pile, land treatment or landfill unit, or final closure of a facility with such a unit. The owner or operator shall notify the Department in writing at least 45 days prior to the date on which the owner or operator expects to begin final closure of a facility with only tanks or containers used for transfer, treatment or storage, or incinerator units to be closed. The owner or operator shall notify the Department in writing at least 45 days prior to the date on which the owner or operator expects to begin partial or final closure of a boiler or industrial furnace, whichever is earlier. The Department may require a longer notice period of up to 180 days for any facility or unit by giving written notice of the longer period if the Department determines that additional time would be required to review and make necessary amendments to the closure plan prior to the initiation of closure. Within 90 days after receiving a notification, the Department may review the closure plan to determine whether any factor has significantly changed since a prior review was undertaken, or determine whether the plan is otherwise adequate or inadequate, and may prescribe additional requirements or request modifications to the plan.

(2) The date when the owner or operator "expects to begin closure" shall be either no later than the date on which any hazardous waste management unit receives the known final volume of hazardous wastes or, if there is a reasonable possibility that the hazardous waste management unit will receive additional hazardous wastes, no later than one year after the date on which the unit received the most recent volume of hazardous waste. The Department may approve an extension to this one-year limit if the owner or operator of a hazardous waste management unit demonstrates to the satisfaction of the Department that the hazardous waste management unit or facility has the capacity to receive additional hazardous wastes, the owner or operator has taken, and will continue to take, all steps necessary to comply with all applicable permit requirements, and the extension will not pose a threat to human health and the environment.

(3) For units meeting the requirements of section 66264.113(d), the date when the owner or operator "expects to begin closure" shall be no later than the date on which the hazardous waste management unit receives the known final volume of non-hazardous wastes, or if there is a reasonable possibility that the hazardous waste management unit will receive additional non-hazardous wastes, no later than one year after the date on which the unit received the most recent volume of non-hazardous wastes. If the owner or operator can demonstrate to the Department that the hazardous waste management unit has the capacity to receive additional non-hazardous wastes and the owner or operator has taken, and will continue to take, all steps to prevent threats to human health and threats to the environment, including compliance with all applicable permit requirements, the Department may approve an extension to this one-year limit. A facility operating under the requirements of section 66264.113

(d) shall be subject to the facility fee specified in Health and Safety Code, Division 20, section 25205.2(d), until the facility has complied with the requirements of section 66264.113(a). Health and Safety Code, Division 20, section 25205.2(d)(4) shall not apply to a facility operating pursuant to section 66264.113(d).

(4) If the facility's permit is terminated, or if the facility is otherwise ordered, by judicial decree or final order under Health and Safety Code section 25358.3 or article 8 of chapter 6.5 of division 20 of the Health and Safety Code, to cease receiving hazardous wastes or to close, then the requirements of this section do not apply.

However, the owner or operator shall close the facility in accordance with the deadlines established in section 66264.113.

TITLE 22. Social Security

Division 4.5. Environmental Health Standards for the Management of Hazardous Waste

Chapter 14. Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities

Article 10. Tank Systems

§66264.197. Closure and Post-Closure Care.

§66264.197. Closure and Post-Closure Care.

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Note

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History

(a) At closure of a tank system, the owner or operator shall remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment contaminated with waste, and manage them as hazardous waste, unless [section 66261.3\(e\)](#) of this division applies. The closure plan, closure activities, cost estimates for closure, and financial responsibility for tank systems shall meet all of the requirements specified in articles 7 and 8 of this chapter.

(b) If the owner or operator demonstrates that not all contaminated soils can be practicably removed or decontaminated as required in subsection (a) of this section, then the owner or operator shall close the tank system and perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills [section 66264.310](#) . In addition, for the purposes of closure, post-closure, and financial responsibility, such a tank system is then considered to be a landfill, and the owner or operator shall meet all of the requirements for landfills specified in articles 7 and 8 of this chapter.

(c) If an owner or operator has a tank system that does not have secondary containment that meets the requirements of [section 66264.193\(b\)](#) through (f) and has not been granted a variance from the secondary containment requirements in accordance with [section 66264.193\(g\)](#), then:

(1) the closure plan for the tank system shall include both a plan for complying with subsection (a) of this section and a contingent plan for complying with subsection (b) of this section;

(2) a contingent post-closure plan for complying with subsection (b) of this section shall be prepared and submitted as part of the permit application;

(3) the cost estimates calculated for closure and post-closure care shall reflect the costs of complying with the contingent closure plan and the contingent post-closure plan, if those costs are greater than the costs of complying with the closure plan prepared for the expected closure under subsection (a) of this section;

(4) financial assurance shall be based on the cost estimates in subsection (c)(3) of this section;

(5) for the purposes of the contingent closure and post-closure plans, such a tank system is considered to be a landfill, and the contingent plans shall meet all of the closure, post-closure, and financial responsibility requirements for landfills under articles 7 and 8 of this chapter.

NOTE

Authority cited: Sections 208, 25150 and 25159, Health and Safety Code. Reference: Sections 25159 and 25159.5, Health and Safety Code; 40 CFR Section 264.197.

HISTORY

1. New section filed 5-24-91; operative 7-1-91 (Register 91, No. 22).

§66264.198. Special Requirements for Ignitable or Reactive Wastes.

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Note

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History



Ignitable or reactive waste shall not be placed in tank systems, unless:

- (1) the waste is treated, rendered, or mixed before or immediately after placement in the tank system so that:
    - (A) the resulting waste, mixture, or dissolved material no longer meets the definition of ignitable or reactive waste under sections 66261.21 or 66261.23 of this division, and
    - (B) section 66264.17(b) is complied with; or
  - (2) the waste is transferred, stored or treated in such a way that it is protected from any material or conditions that may cause the waste to ignite or react; or
  - (3) the tank system is used solely for emergencies.
- (b) The owner or operator of a facility where ignitable or reactive waste is transferred, stored or treated in a tank shall comply with the requirements for the maintenance of protective distances between the waste management area and any public ways, streets, alleys, or an adjoining property line that can be built upon as required in Tables 2-1 through 2-6 of the National Fire Protection Association's "Flammable and Combustible Liquids Code," (1981), (incorporated by reference, see section 66260.11).

#### NOTE

Authority cited: Sections 208, 25150 and 25159, Health and Safety Code. Reference: Sections 25159 and 25159.5, Health and Code; 40 CFR Section 264.198.



**TITLE 22. Social Security****Division 4.5. Environmental Health Standards for the Management of Hazardous Waste****Chapter 14. Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities****Article 11. Surface Impoundments****§66264.228. Closure and Postclosure Care.****§66264.228. Closure and Postclosure Care.**• [Note](#) • [History](#)

(a) At closure, the owner or operator shall:

(1) remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate, and manage them as hazardous waste unless section 66261.3(d) applies; or

(2)(A) ~~eliminate free liquids by removing liquid wastes or solidifying the remaining wastes and waste residues;~~

(B) ~~stabilize remaining wastes to a bearing capacity sufficient to support final cover; and~~

(C) cover the surface impoundment with a final cover designed and constructed to:

1. prevent the downward entry of water into the closed impoundment throughout a period of at least 100 years;

2. function with minimum maintenance;

3. promote drainage and minimize erosion or abrasion of the final cover;

4. accommodate settling and subsidence so that the cover's integrity is maintained; and

5. have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present;

6. accommodate lateral and vertical shear forces generated by the maximum credible earthquake so that the integrity of the cover is maintained;

7. preclude ponding of rainfall and surface run-on over the closed area.

(b) If some waste residues, contaminated materials or contaminated soils are left in place at final closure, the owner or operator shall comply with all postclosure requirements contained in sections 66264.117 through 66264.120, including maintenance and monitoring throughout the postclosure care period (specified in the permit under section 66264.117). The owner or operator shall:

(1) close the facility in a manner that will minimize any chance of postclosure release of hazardous waste or discarded hazardous material; facilitate postclosure maintenance, monitoring and emergency response; and require minimum maintenance of containment structures, leachate collection systems and surface drainage collection or diversion systems;

(2) maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion or other events;

(3) maintain and monitor the leachate collection and removal system which also serves as a leak detection system;

(4) maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of article 6 of this chapter;

(5) prevent run-on and run-off from eroding or otherwise damaging the final cover, and

6. Maintain and monitor the leak detection system in accordance with sections 66264.221(c)(2)(D) and (c)(3) and 66264.226(d), and comply with all other applicable leak detection system requirements of this chapter;

(c)(1) If an owner or operator plans to close a surface impoundment in accordance with subsection (a)(1) of this

section, then:

(A) the closure plan for the impoundment under section 66264.112 shall include both a plan for complying with subsection (a)(1) of this section and a contingent plan for complying with subsection (a)(2) of this section in case not all contaminated subsoils can be practicably removed at closure; and

(B) the owner or operator shall prepare a contingent postclosure plan under section 66264.118 for complying with subsection (b) of this section in case not all contaminated subsoils can be practicably removed at closure.

(2) The cost estimates calculated under sections 66264.142 and 66264.144 for closure and postclosure care of an impoundment subject to this paragraph shall include the cost of complying with the contingent closure plan and the contingent postclosure plan.

(d) During the postclosure care period, if liquids leak into a leak detection system, the owner or operator shall notify the Department of the leak in writing within seven (7) days after detecting the leak.

(e) If waste is to remain in a unit after closure, the owner or operator shall comply with, and plan for compliance with the following:

(1) The unit shall be compacted before any portion of the final cover is installed.

(2) (reserved).

(3) (reserved).

(4) A foundation layer shall be provided for the compacted barrier layer of the final cover. If needed, the foundation layer shall contain herbicide sufficient to prevent vegetative growth, and shall be free of decomposable organic matter. The layer shall be compacted at a moisture content sufficient to achieve the density required to provide adequate support for the nonearthen membrane.

(5) A compacted barrier layer of clean earth shall be provided above the foundation layer, and shall be provided around the unit to a depth as low as the level at which the owner or operator has deposited waste, to prevent lateral migration of waste and gas and vapor from the waste. The layer of earth shall be wholly below the average depth of frost penetration, and shall be compacted at a moisture content sufficient to achieve a percent compaction that has been demonstrated, with the specific cover material to be used, to prevent the downward entry of water into the foundation layer for a period of at least 100 years.

(6) The earthen material shall contain herbicide sufficient to prevent growth of vegetation. The slope of the final top surface of the compacted barrier layer shall be sloped after allowance for settling and subsidence to prevent the build up of hydraulic head.

(7) the owner or operator may use nonearthen materials for the barrier layer provided it is demonstrated to the satisfaction of the Department that a barrier layer of alternative composition will equally impede movement of fluid and be as durable as a compacted earthen barrier.

(8) If hazardous waste is underlain by a liner containing a synthetic membrane, then a synthetic membrane shall be provided in the final cover above the compacted barrier layer. The membrane shall be made of material chemically resistant to the waste at the facility, whether or not contact between the membrane and the waste is anticipated, and shall have thickness and strength sufficient to withstand the stresses to which it shall be included shear forces, puncture from rocks or penetration from roots.

(9) If a synthetic membrane is used in the final cover system, the owner or operator shall provide a layer of material above the synthetic membrane of the final cover, and a layer of material below this synthetic membrane, to protect the membrane from damage.

(10) The owner or operator shall provide a water drainage layer, blanket or channel above the compacted barrier layer of the final cover to provide a path for water to exit rapidly.

(11) The owner or operator shall provide a filter layer above the water drainage layer to prevent soils from clogging the drainage layer.

(12) The owner or operator shall provide a layer of top soil of thickness sufficient to support vegetation for erosion controlled deep enough to prevent root penetration into the filter layer. The top soil shall have characteristics to protect the compacted layer against drying that would lead to cracking, to resist erosion and to

support vegetation growth.

(13) Permanent disposal areas shall be graded at closure so that with allowance for settling and subsidence, the slope of the land surface above all portions of the cover, shall be sufficient to prevent ponding of water. Such areas shall be graded to drain precipitation away from the disposal area. Portions of the land surface above the cover unavoidably slopes great enough to invite erosion which cannot be readily controlled by vegetation shall be protected by gunite, riprap or other material sufficient to provide erosion control.

(14) Unless vegetation on the cover would pose a significant fire hazard unacceptable to the fire prevention authority or would interfere with a planned postclosure use of the site that is acceptable to the Department, the owner or operator shall provide conditions favorable for hearty growth of vegetation that will provide erosion control without forming roots that would penetrate the compacted earth cover, and shall estimate the cost of providing such conditions and vegetation as part of the cost of closure. Vegetation for closed disposal areas shall be selected to require minimum watering and maintenance. Plantings shall not impair the integrity of containment structures or the final cover.

(15) At and after closure, permanent disposal areas shall have drainage systems capable of transporting water from the water drainage layer away from the closed facility and capable of diverting surface runoff away from or around disposal areas, containment structures, leachate collection systems and monitoring facilities. Drainage systems shall be capable of preventing erosion of containment structures. Drainage system components themselves shall be lined or otherwise protected against erosion.

(16)(A) When closing a permanent disposal site, the owner or which the horizontal location and elevation of the cover and other containment features, monitoring facilities and drainage features can be determined throughout the entire postclosure care period. All survey work shall conform to accepted survey practices and be performed and certified by a licensed land surveyor or registered professional engineer licensed to practice surveying.

(B) The owner or operator shall submit a copy of the surveyor's notes used to establish the benchmarks described in this subsection in accordance with section 66264.116.

(17) The owner or operator shall provide in the closure plan predictions of the magnitude of the drops in elevation that will occur at various portions of the top surface of the final cover as a result of settling and subsidence. The prediction shall account for compression of material underlying the liner (or underlying the waste if there is no liner) and compression of the liner, waste, fill and cover. The prediction of the drop in elevation due to compression shall account for immediate settlement, primary consolidation, secondary consolidation and creep, liquefaction and dynamic consolidation due to earthquake loads.

(18) If the following information has not already been submitted to the Department and if dikes and hazardous waste will remain at the site after closure, the owner or operator shall provide in the closure plan proof that the dikes have sufficient structural integrity to withstand forces to which they can be exposed during and after closure, including the following:

(A) descriptions of topography and site conditions as required by section 66270.14(b)(18);

(B) depiction of the design layout, sections and details of the impoundment and its components, including cover, dike, liner, drainage and leak detection system;

(C) a description of, and the results of, stability analyses for the following conditions:

1. foundation soil bearing failure;

2. failure in the dike slopes; and

3. build-up of hydrostatic pressure due to failure of drainage system and cover, considering the potential for piping and erosion;

(D) strength and compressibility test results pertaining to the dike material;

(E) descriptions of dike construction and postclosure maintenance procedures with schedules and specifications;

(F) descriptions of subsurface soil conditions, groundwater levels, bedrock conditions and seismic setting of the site;

(G) discussion of the occurrence or nonoccurrence of the following factors and the significance of those factors to

the integrity of the dikes:

1. frost, freezing, wind, rain, temperature variations, effects of vegetation and animals and activities of humans;
2. adversely oriented joints, slickensides or fissured material, faults, seams of soft materials and weak layers;
3. potential for liquefaction during earthquakes coincident with existence of saturated conditions due to failure of drainage system and cover;

(H) a certification by a professional engineer registered in California that the dikes have sufficient structural integrity to withstand forces to which they can be exposed during and after closure, based on analyses, tests and inspections that include the following:

1. a review of all the geologic, geotechnical, geohydrologic and other pertinent design, construction and service data;
2. a review of all climatic data, and special geologic events, such as earthquakes, which occurred during the entire period the impoundment was in service;
3. a field inspection to detect signs of settlement, subsidence, cracks, scouring, erosion, slides, holes, piping, seepage, sloughing, condition of vegetation, etc.; and
4. a determination if the original design was adequate and a review of possible changes in parameters used in the original design.

(19) The owner or operator shall include in the closure plan an explanation of how the cover, construction procedures and planned postclosure care are designed to accommodate or avoid the effects of differential settlement and consolidation without loss of integrity of the cover.

(f) Before installing the compacted barrier layer of the final cover the owner or operator shall accurately establish the correlation between the desired permeability and the density at which that permeability is achieved. To accomplish this the owner or operator shall:

1. provide a representative foundation area for a test compacted barrier layer having drainage conditions representative of the closed facility under the compacted barrier layer;

(2) install a compacted barrier layer over that test area that has the depth and materials of construction that the compacted barrier layer for the entire landfill is planned to have, and that is compacted in the manner planned for the compacted barrier layer for the entire landfill;

(3) undertake permeability tests in the test area saturated conditions that represent the maximum hydraulic head could be exerted on the compacted barrier layer of the final cover. A sufficient number of tests shall be run to verify the results. A permeability test shall commence after the test apparatus has run for a time long enough to allow the required daily rate of replenishment water to maintain constant head or to follow an asymptotic or constant trend. The rate of evaporation from the test equipment used to determine permeability shall be established;

(4) undertake a sufficient number of tests in the test area to determine the average density at which permeability complying with subsection (e)(5) of this section is obtained.

(g) The owner or operator shall comply with the following when installing the compacted barrier layer of the final cover.

(1) In each day in which final cover material is compacted, the owner or operator shall establish a grid on the upper surface of each layer compacted that day and randomly conduct density tests. A sufficient number of tests shall be conducted to confirm the effectiveness and uniformity of the compaction.

(2) If the Department indicates areas where compaction tests will be needed, the owner or operator shall undertake such tests in those areas.

(3) If the average of the values of compaction from the tests is lower than the average density pursuant to subsection (f)(4) of this section, the entire layer installed on the day represented by the tests shall be removed and replaced with another layer compacted so that compaction tests taken indicate a density higher than the average density determined pursuant to subsection (f)(4) of this section.

(4) An independent, qualified person registered in California as a professional engineer or certified in California as an engineering geologist shall supervise the undertaking of all tests for permeability and percent compaction,

shall supervise the construction of the final cover and shall prepare a report to be submitted to the Department which bears his or her signature and the date of the signature, and describes the results of all tests and indicates whether or not the cover, as installed, complies with the requirements of this chapter.

(5) Before starting compaction of earthen material to form the compacted barrier layer of the cover, the owner or operator shall submit to the Department the results of the following determinations, on material to be used for the compacted barrier layer of the final cover:

- (A) percent fines;
- (B) plastic limit, liquid limit, plasticity index and shrinkage factors;
- (C) soil classification;
- (D) carbon content;
- (E) concentration of soluble salts in soil pore water.

(h) All slopes shall be designed and constructed to minimize the potential for failure. Any slope failure occurring within the site shall be promptly stabilized and the Department and the appropriate regional board shall be notified immediately by the owner or operator of such failure and the methods taken for stabilization.

(i) Adequate facilities shall be provided to ensure for a 100 year period that no leachate shall be discharged to surface waters or groundwater, except as authorized by the hazardous waste facility permit.

(j) Hazardous waste and discarded hazardous material contained in the closed facility shall be protected from washout and erosion as the result of tides or floods having a predicted frequency of once in 100 years.

(k) An inspection and monitoring program shall be established at every closed disposal area wherein an independent, qualified engineer registered in California shall annually evaluate and document the condition of all surface improvements, drainage facilities, erosion control facilities, vegetative cover, gas control facilities and monitoring facilities. This program shall also document the presence of any water or leachate flowing from the disposal area. The engineer shall evaluate the following and the effects of the following:

- (1) condition of access control (fences and gates),
- (2) condition of vegetation,
- (3) erosion,
- (4) cracking,
- (5) disturbance by cold weather,
- (6) seepage,
- (7) slope stability,
- (8) subsidence,
- (9) settlement,
- (10) monitoring the leak detection system, if there is one,
- (11) operation of the leachate collection and removal system,
- (12) monitoring the groundwater monitoring system,
- (13) condition of run-on and run-off control systems, and
- (14) condition of surveyed benchmarks.

The program shall be continued by the owner or operator of the disposal area throughout the postclosure care period. A copy of the annual report containing the above-cited observations shall be filed in a timely manner with the Department and the appropriate regional board.

(l) [Reserved]

(m) All constructed features which will remain at permanent disposal areas containing hazardous waste material shall be able to withstand the maximum credible earthquake without significant damage to foundations, structures, waste containment features and features which control leachate, surface drainage, erosion and gas.

(n) (Reserved)

- (o) If monitoring equipment or other features which are required to be operable after closure of the facility pursuant to this chapter are rendered inoperable, the owner or operator shall render it operable or replace it with operable equipment or other features.
- (p) Postclosure care which the owner or operator shall provide for shall include the conducting of surveys by a licensed land surveyor, to determine the horizontal location and elevation of the cover and other containment features, monitoring facilities and drainage features, and markers installed at the site pursuant to subsection (e) (16) of this section. Such surveys shall be taken annually.
- (q) The owner or operator shall reconstruct the closed facility to restore slopes and other conditions to conform to the requirements of this chapter when movement at the site has caused them not to comply with such requirements.
- (r) The owner or operator shall submit annual reports to the Department describing measures undertaken at the site during the postclosure maintenance period.

#### NOTE

Authority cited: Sections 208, 25150, 25159, 25159.5 and 25245, Health and Safety Code; and Governor's Reorganization Plan Number 1 of 1991. Reference: Sections 25150, 25159 and 25159.5, Health and Safety Code; and 40 CFR Section 264.228.

#### HISTORY

1. New section filed 5-24-91; operative 7-1-91 (Register 91, No. 22).
2. Amendment of subsections (b)(4)-(5), new subsection (b)(6) and amendment of Note filed 7-19-95; operative 8-18-95 (Register 95, No. 29).

**TITLE 22. Social Security**

**Division 4.5. Environmental Health Standards for the Management of Hazardous Waste**

**Chapter 14. Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities**

**Article 12. Waste Piles**

**§66264.258. Closure and Post-Closure Care.**

**§66264.258. Closure and Post-Closure Care.**



• [Note](#) • [History](#)

(a) At closure, the owner or operator shall remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate, and manage them as hazardous waste unless [section 66261.3\(d\)](#) applies.

(b) If, after removing or decontaminating all residues and making all reasonable efforts to effect removal or decontamination of contaminated components, subsoils, structures, and equipment as required in subsection (a) of this section, the owner or operator finds that not all contaminated subsoils can be practicably removed or decontaminated, the owner or operator shall close the facility and perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills ([section 66264.310](#) ).

(c)(1) The owner or operator of a waste pile shall:

(A) include in the closure plan for the pile under [section 66264.112](#) both a plan for complying with subsection (a) of this section and a contingent plan for complying with subsection (b) of this section in case not all contaminated subsoils can be practicably removed at closure; and

(B) prepare a contingent post-closure plan under [section 66264.118](#) for complying with subsection (b) of this section in case not all contaminated subsoils can be practicably removed at closure.

(2) The cost estimates calculated under [sections 66264.142](#) and [66264.144](#) for closure and post-closure care of a pile subject to this subsection shall include the cost of complying with the contingent closure plan and the contingent post-closure plan.

**NOTE**

Authority cited: Sections 208, 25150, 25159, Health and Safety Code. Reference: Sections 25150, 25159, 25159.5 and 25245, Health and Safety Code; 40 CFR Section 264.258.

**HISTORY**

1. New section filed 5-24-91; operative 7-1-91 (Register 91, No. 22).

**§66264.259. Special Requirements for Hazardous Wastes F020, F021, F022, F023, F026, and F027.**



• [Note](#) • [History](#)

(a) Hazardous Wastes F020, F021, F022, F023, F026, and F027 shall not be placed in waste piles unless the owner or operator operates the waste pile in accordance with a management plan for these wastes that is approved by the Department pursuant to the standards set out in this subsection, and in accord with all other applicable requirements of this chapter. The factors to be considered are:

(1) the volume, physical, and chemical characteristics of the wastes, including their potential to migrate through soil or to volatilize or escape into the atmosphere;

(2) the attenuative properties of underlying and surrounding soils or other materials;



- (3) the mobilizing properties of other materials co-disposed with these wastes; and
- (b) The Department shall impose additional design, operating, and monitoring requirements for piles managing hazardous wastes F020, F021, F022, F023, F026, and, F027 if necessary to reduce the possibility of migration of these wastes to ground water, surface water, or air so as to protect human health and the environment.

#### NOTE

Authority cited: Sections 208, 25150 and 25159, Health and Safety Code. Reference: Sections 25150, 25159 and 25159.5, Health and Safety Code; 40 CFR Section 264.259.

#### HISTORY

1. New section filed 5-24-91; operative 7-1-91 (Register 91, No. 22).



**TITLE 22. Social Security****Division 4.5. Environmental Health Standards for the Management of Hazardous Waste****Chapter 14. Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities****Article 13. Land Treatment****§66264.280. Closure and Post-Closure Care.****§66264.280. Closure and Post-Closure Care.**• [Note](#) • [History](#)

(a) During the closure period the owner or operator shall:

- (1) continue all operations (including pH control) necessary to maximize degradation, transformation, or immobilization of constituents of concern within the treatment zone as required under [section 66264.273\(a\)](#), except to the extent such measures are inconsistent with subsection (a)(7) of this section;
- (2) continue all operations in the treatment zone to prevent run-off of constituents of concern as required under [section 66264.273\(b\)](#);
- (3) maintain the run-on control system required under [section 66264.273\(c\)](#);
- (4) maintain the run-off management system required under [section 66264.273\(d\)](#);
- (5) control wind dispersal of hazardous waste if required under [section 66264.273\(f\)](#);
- (6) continue vadose zone monitoring in compliance with [section 66264.278](#), except that soil-pore liquid monitoring may be terminated after the waste added to the treatment zone has been shown to the satisfaction of the Department to have been completely degraded, immobilized or transformed, but in no event can monitoring be discontinued in less than 90 days after the last application of waste to the treatment zone; and
- (7) control of the release of airborne contaminants to below hazardous or nuisance levels or other levels as necessary to protect human health or the environment;
- (8) establish a vegetative cover on the portion of the facility being closed at such time that the cover will not substantially impede degradation, transformation, or immobilization of constituents of concern in the treatment zone. The vegetative cover shall be capable of maintaining growth without extensive maintenance.

(b) For the purpose of complying with [section 66264.115](#), when closure is completed the owner or operator may submit to the Department certification by an independent qualified soil scientist or an independent, California Certified Engineering Geologist in lieu of an independent California registered professional engineer, that the facility has been closed in accordance with the specifications in the approved closure plan.

(c) During the post-closure care period the owner or operator shall:

- (1) continue all operations (including pH control) necessary to enhance degradation and transformation and sustain immobilization of constituents of concern in the treatment zone to the extent that such measures are consistent with other post-closure care activities;
- (2) maintain a vegetative cover over closed portions of the facility;
- (3) maintain run-on control system required under [section 66264.273\(c\)](#);
- (4) maintain the run-off management system required under [section 66264.273\(d\)](#);
- (5) control wind dispersal of hazardous waste if required under [section 66264.273\(f\)](#);
- (6) continue vadose zone monitoring in compliance with [section 66264.278](#) and [section 66264.280\(a\)\(6\)](#); and
- (7) control of the release of airborne contaminants to below hazardous or nuisance levels or other levels as necessary to protect human health or the environment.

(d) The owner or operator is not subject to regulation under subsections (a)(7) and (c) of this section if the

Department finds that the level of constituents of concern in the treatment zone soil does not exceed the background value of those constituents by an amount that is statistically significant when using the test specified in subsection (d)(3) of this section and that the waste in the treatment zone has been shown to the satisfaction of the Department to have been completely degraded, transformed or immobilized. The owner or operator may submit such a demonstration to the Department at any time during the closure or post-closure care periods. For the purposes of this subsection:

(1) the owner or operator shall establish background soil values and determine whether there is a statistically significant increase over those values for all constituents of concern specified in the facility permit under section 66264.271(b);

(A) background soil concentrations may be based on a one-time sampling of a background plot having characteristics similar to those of the treatment zone where soil has not been contacted by constituents of waste;

(B) the owner or operator shall express background values and values for constituents of concern in the treatment zone in a form necessary for the determination of statistically significant increases under subsection (d)(3) of this section;

(2) in taking samples used in the determination of background and treatment zone concentrations, the owner or operator shall take samples at a sufficient number of sampling points and at appropriate locations and depths to yield samples that represent the chemical make-up of soil that has not been affected by leakage from the treatment zone and the soil within the treatment zone, respectively;

(3) in determining whether a statistically significant increase has occurred, the owner or operator shall compare the concentration of each constituent in the treatment zone to the background concentration for that constituent using a statistical procedure that provides reasonable confidence that constituent presence in the treatment zone will be identified. The owner or operator shall use a statistical procedure that:

(A) is appropriate for the distribution of the data used to establish background concentrations; and

(B) provides a reasonable balance between the probability of falsely identifying a statistically significant increase for a constituent of concern in the treatment zone and the probability of failing to identify a statistically significant increase in the treatment zone.

#### NOTE

Authority cited: Sections 208, 25150 and 25159, Health and Safety Code. Reference: Sections 25150, 25159, 25159.5 and 25245, Health and Safety Code; 40 CFR Section 264.280.

#### HISTORY

1. New section filed 5-24-91; operative 7-1-91 (Register 91, No. 22).

### **§66264.281. Special Requirements for Ignitable or Reactive Waste.**

**§** • Note • History

The owner or operator shall not apply ignitable or reactive waste to the treatment zone unless the waste and the treatment zone meet all applicable requirements of chapter 18 of this division, and:

(a) the waste is immediately incorporated into the soil so that:

(1) the resulting waste, mixture, or dissolution of material no longer meets the definition of ignitable or reactive waste under sections 66261.21 or 66261.23 of this chapter; and

(2) section 66264.17(b) is complied with; or

(b) the waste is managed in such a way that it is protected from any material or conditions which may cause it to ignite or react.

#### NOTE

Authority cited: Sections 208, 25150 and 25159, Health and Safety Code. Reference: Sections 25150, 25159 and 25159.5, Health and Safety Code; 40 CFR Section 264.281.

#### HISTORY

1. New section filed 5-24-91; operative 7-1-91 (Register 91, No. 22).
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**TITLE 22. Social Security****Division 4.5. Environmental Health Standards for the Management of Hazardous Waste****Chapter 14. Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities****Article 14. Landfills****§66264.310. Closure and Post-Closure Care.****§ 66264.310 . Closure and Post-Closure Care.**

[§](#) • [Note](#) • [History](#)

(a) At final closure of the landfill or upon closure of any cell, the owner or operator shall cover the landfill or cell with a final cover designed and constructed to:

- (1) prevent the downward entry of water into the closed landfill throughout a period of at least 100 years;
- (2) function with minimum maintenance;
- (3) promote drainage and minimize erosion or abrasion of the cover;
- (4) accommodate settling and subsidence so that the cover's integrity is maintained;
- (5) accommodate lateral and vertical shear forces generated by the maximum credible earthquake so that the integrity of the cover is maintained;
- (6) have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present; and

(b) conform to the provisions of subsections (e) through (r) of [section 66264.228](#), except that the Department shall grant a variance from any requirement of subsections (e) through (r) which the owner or operator demonstrates to the satisfaction of the Department is not necessary to protect public health, water quality or other environmental quality.

(b) After final closure, the owner or operator must comply with all post-closure requirements contained in [sections 66264.117 through 66264.120](#), including maintenance and monitoring throughout the post-closure care period specified in the permit under [section 66264.117](#). The owner or operator must:

- (1) maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events;
- (2) continue to operate the leachate collection and removal system until leachate is no longer detected;
- (3) maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of article 6 of this chapter;
- (4) prevent run-on and run-off from eroding or otherwise damaging the final cover;
- (5) protect and maintain surveyed benchmarks used in complying with [section 66264.309](#), and
- (6) maintain and monitor the leak detection system in accordance with [Sections 66264.301\(c\)\(3\)\(D\) and \(c\)\(4\) and 66264.303\(c\)](#), and comply with all other applicable leak detection system requirements of this part;

(c) Unless the owner or operator can demonstrate to the satisfaction of the Department that significant amounts of toxic or flammable gas or vapor will not be emitted by waste and that no gas will be emitted that is capable of disrupting the cover or causing other property damage, the owner or operator shall provide a control system designed to prevent migration of gas. The control system shall be designed to collect gases that are emitted from the buried waste and convey gas or vapor to a flare, incinerator or treatment device that will render the gas or vapor harmless to public health or safety, or to a collection system that allows gas to be exported for use or treatment elsewhere. Any gas collection system used shall be designed to withstand pressures that may result from overburden weight of structures that may overlie the cover, and traffic that may occur.

(d) If gas or vapor that can be expected to be emitted from buried waste after closure would be flammable or toxic, the owner shall describe in the closure plan measures to render such gases or vapors harmless, or export such gases from the site, for as many years as they would be emitted from the waste, and shall estimate the cost of such measures as part of the cost of closure and post-closure care of the facility. In that case, the closure plan shall provide a map showing:

- (1) the number, spacing and locations of wells to be used for gas extraction;
- (2) the location and spacing of piping. Also in that case, the closure plan shall describe the equipment and capability of equipment, to be provided to render gases or vapor harmless or export gas for use or treatment elsewhere. If pumping would be needed to assure that such gas is withdrawn at a rate sufficient to avoid hazardous accumulation of gas or vapor or uncontrolled migration of such gas or vapor or uncontrolled migration of such gas or vapor from the facility, the owner or operator shall describe measures to provide such pumping for as many years as such gas or vapor will be emitted from the waste, and shall estimate the cost of such measures as part of the cost of closure and post-closure care of the facility. The closure plan shall in that case describe the type of pump, volume of gas the pump can move per unit time, and the estimated distances from the pump from which gas can be extracted from the landfill. The owner or operator shall provide such measures as needed.

#### NOTE

Authority cited: Sections 25150 and 25159, Health and Safety Code; and Governor's Reorganization Plan Number 1 of 1991.  
Reference: Sections 25159, 25159.5 and 25245, Health and Safety Code; and 40 CFR Section 264.310.

#### HISTORY

1. New section filed 5-24-91; operative 7-1-91 (Register 91, No. 22).
2. Amendment of subsections (b)(4)-(5), new subsection (b)(6) and amendment of Note filed 7-19-95; operative 8-18-95 (Register 95, No. 29).

### **66264.312. Special Requirements for Ignitable or Reactive Waste.**

**§** • [Note](#) • [History](#)

(a) Except as provided in [section 66264.316](#), ignitable or reactive waste shall not be placed in a landfill, unless the waste and landfill meet all applicable requirements of chapter 18 of this division, and the waste is treated, rendered, or mixed before or immediately after placement in a landfill so that:

- (1) the resulting waste, mixture, or dissolution of material no longer meets the definition of ignitable or reactive waste under 66261.21 or 66261.23 of this chapter; and
- (2) [section 66264.17\(b\)](#) is complied with.

#### NOTE

Authority cited: Sections 208, 25150 and 25159, Health and Safety Code. Reference: Sections 25150, 25159 and 25159.5, Health and Safety Code; 40 CFR Section 264.312.

#### HISTORY

**TITLE 22. Social Security****Division 4.5. Environmental Health Standards for the Management of Hazardous Waste****Chapter 14. Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities****Article 15. Incinerators****§66264.351. Closure.****§66264.351. Closure.**• [Note](#) • [History](#)

(a) At closure the owner or operator shall remove all hazardous waste and hazardous waste residues (including, but not limited to, ash, scrubber waters, and scrubber sludges) from the incinerator site.

(b) At closure, as throughout the operating period, unless the owner or operator can demonstrate, in accordance with [section 66261.3\(d\)](#), that the residue removed from the incinerator is not a hazardous waste, the owner or operator becomes a generator of hazardous waste and shall manage it in accordance with applicable requirements of this division.

**NOTE**

Authority cited: Sections 208 and 25159, Health and Safety Code. Reference: Sections 25159.5 and 25200, Health and Safety Code; 40 CFR Section 264.351.

**HISTORY**

1. New section filed 5-24-91; operative 7-1-91 (Register 91, No. 22).

**Article 15.5. Corrective Action for Waste Management Units****§66264.500. [Reserved].**• [History](#)**HISTORY**

1. New article 15.5 filed 12-23-93 as an emergency; operative 12-23-93 (Register 93, No. 52). A Certificate of Compliance must be transmitted to OAL by 5-9-94 or emergency language will be repealed by operation of law on the following day.
2. New article 15.5 refiled 4-25-94 as an emergency; operative 4-25-94 (Register 94, No. 17). A Certificate of Compliance must be transmitted to OAL by 8-23-94 or emergency language will be repealed by operation of law on the following day.
3. New article 15.5 refiled 8-22-94 as an emergency; operative 8-22-94 (Register 94, No. 34). A Certificate of Compliance must be transmitted to OAL by 12-20-94 or emergency language will be repealed by operation of law on the following day.
4. New article 15.5 refiled 6-29-95 as an emergency; operative 6-29-95 (Register 95, No. 26). A Certificate of Compliance must be transmitted to OAL by 10-27-95 or emergency language will be repealed by operation of law on the following day.
5. New article 15.5 refiled 10-26-95 as an emergency; operative 10-26-95 (Register 95, No. 43). A Certificate of Compliance must be transmitted to OAL by 2-23-96 or emergency language will be repealed by operation of law on the following day.
6. Certificate of Compliance as to 10-26-95 order transmitted to OAL 11-30-95 and filed 1-16-96 (Register 96, No. 3).

**§66264.550. Applicability of Corrective Action Management Unit (CAMU) Regulations.**

**TITLE 22. Social Security****Division 4.5. Environmental Health Standards for the Management of Hazardous Waste****Chapter 14. Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities****Article 16. Miscellaneous Units****§66264.601. Environmental Performance Standards.****§66264.601. Environmental Performance Standards.**• [Note](#) • [History](#)

A miscellaneous unit shall be located, designed, constructed, operated, maintained, and closed in a manner that will ensure protection of human health and the environment. Permits for miscellaneous units shall contain such terms and provisions as necessary to protect human health and the environment, including, but not limited to, appropriate, design and operating requirements, detection and monitoring requirements, and requirements for responses to releases of hazardous waste or hazardous waste constituents from the unit. Permit terms and provisions shall include those requirements of articles 9 through 15 and articles 27, 28 and 28.5 of this chapter, chapter 20, 40 CFR Part 146, and article 5.5 of chapter 6.5 of division 20 of the Health and Safety Code (commencing with section 25100) that are appropriate for the miscellaneous unit being permitted. Protection of human health and the environment includes, but is not limited to:

(a) prevention of any releases that may have adverse effects on human health or the environment due to migration of waste constituents, hazardous constituents, or reaction products, in the ground water or subsurface environment, considering:

- (1) the volume and physical and chemical characteristics of the waste in the unit, including its potential for migration through soil, liners, or other containing structures;
- (2) the hydrologic and geologic characteristics of the unit and the surrounding area;
- (3) the existing quality of ground water and soil-pore liquid and gas, including other sources of pollution and contamination and their cumulative impact on the ground water and the normally unsaturated zone;
- (4) the quantity and direction of groundwater flow;
- (5) the proximity to and withdrawal rate of current and potential groundwater users;
- (6) the patterns of land use in the region;
- (7) the potential for deposition or migration of waste constituents, hazardous constituents, or reaction products, into subsurface physical structures, and into the root zone of food-chain crops and other vegetation;
- (8) the potential for health risks caused by human exposure to constituents of concern; and
- (9) the potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to constituents of concern;

(b) prevention of any releases that may have adverse effects on human health or the environment due to migration of waste constituents, hazardous constituents, or reaction products, in surface water, or wetlands or on the soil surface considering:

- (1) the volume and physical and chemical characteristics of the waste in the unit;
- (2) the effectiveness and reliability of containing, confining, and collecting systems and structures in preventing migration;
- (3) the hydrologic characteristics of the unit and the surrounding area, including the topography of the land around the unit;
- (4) the patterns of precipitation in the region;



- (5) the quantity, quality, and direction of ground-water flow;
  - (6) the proximity of the unit to surface waters;
  - (7) the current and potential uses of nearby surface waters and any water quality standards established for those surface waters;
  - (8) the existing quality of surface waters and surface soils, including other sources of pollution and contamination and their cumulative impact on surface waters and surface soils;
  - (9) the patterns of land use in the region;
  - (10) the potential for health risks caused by human exposure to constituents of concern; and
  - (11) the potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to constituents of concern;
- (c) prevention of any release that may have adverse effects on human health or the environment due to migration of waste constituents, hazardous constituents, or reaction products, in the air, considering:
- (1) the volume and physical and chemical characteristics of the waste in the unit, including its potential for the emission and dispersal of gases, aerosols, and particulates;
  - (2) the effectiveness and reliability of systems and structures to reduce or prevent emissions of hazardous constituents to the air;
  - (3) the operating characteristics of the unit;
  - (4) the atmospheric, meteorologic, and topographical characteristics of the unit and the surrounding area;
  - (5) the existing quality of the air, including other sources of pollution and contamination and their cumulative impact on the air;
  - (6) the potential for health risks caused by human exposure to constituents of concern; and
  - (7) the potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to constituents of concern.

#### NOTE

Authority cited: Sections 208, 25150, 25159, 25159.5, 25245 and 58012, Health and Safety Code. Reference: Sections 25150, 25159 and 25159.5, Health and Safety Code; and 40 CFR Section 264.601.

#### HISTORY

1. New section filed 5-24-91; operative 7-1-91 (Register 91, No. 22).
2. Change without regulatory effect amending first paragraph and Note filed 6-11-99 pursuant to Health and Safety Code section 25159.1 (Register 99, No. 24).

### §66264.602. Monitoring, Analysis, Inspection, Response, Reporting, and Corrective Action.



• [Note](#) • [History](#)

Monitoring, testing, analytical data, inspections, response, and reporting procedures and frequency shall ensure compliance with [sections 66264.15](#), [66264.33](#), [66264.75](#), [66264.76](#), [66264.77](#), [66264.601](#) and [66264.801](#) as well as meet any additional requirements needed to protect human health and the environment as specified in the permit.

#### NOTE

Authority cited: Sections 208, 25150 and 25159, Health and Safety Code. Reference: Sections 25159 and 25159.5, Health and Safety Code; 40 CFR Section 264.602.

#### HISTORY

October 24, 2001

Mr. Mark Lewis  
Tetra Tech EM Inc.  
9107 Bluebonnet Centre Blvd. Ste. B  
Baton Rouge, LA 70809

**RE: Purity Oil Sales Superfund, Fresno, California**

**Subject: RFI No. 27 - Proposed Change in Subgrade Specifications**

Dear Mr. Lewis,

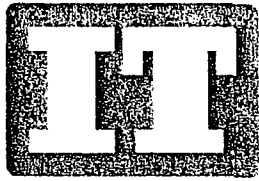
SECOR is forwarding a copy of RFI No. 27. This RFI document addresses the proposal to alter the sub-grade compaction requirement. I am submitting this document on behalf of Chevron from the IT Corporation.

If you have any questions please call me at (517) 202-5617.

Thanks,

Scott Jordan

SECOR International Incorporated



**IT CORPORATION**

*A Member of The IT Group*

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## REQUEST FOR INFORMATION

RFI NO. 27

October 23, 2001

TO: Mark Lewis  
FOR: Tetra Tech EM Inc.  
Tel: (559) 486-1695

**JOB: PURITY OIL SUPERFUND SITE PROJECT**

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**Subject: Proposed Change in Subgrade Specifications**

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**Current Requirement:**

**Section 02211 Earthwork:**

**3.3 Subgrade Earthwork**

**A. Subgrade excavation & C. Subgrade fill construction**

See attachment 1 for details.

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**Proposed Change:**

See attachment 2 for details.

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**Technical Justification for Proposed Change:**

See attachment 2 for details.

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**DATE THE ABOVE INFORMATION IS REQUIRED: October 29, 2001**

***SEE ATTACHMENT 2 FOR STAMP AND SIGNATURE***

By: Sunil S Kishnani, PhD, PE

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Comments:

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EPA Approval:

---

Name (print)

---

Signature

---

Date

**RFI 27 - Proposed Change in Subgrade Specifications**

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# Attachments

# Attachments

1. Section 02211 Earthwork
2. Proposed Change in  
Subgrade Specification

# Attachment 1

Section 02211 Earthwork

**SECTION 02211****EARTHWORK****PART 1: GENERAL**

The general provisions of the contract, including the general and special conditions and the requirements of Division 1, apply to the work specified in this section.

**1.1 SECTION INCLUDES**

- A. Subgrade excavation,
- B. Disposal of excess/unsuitable excavated materials,
- C. Subgrade fill placement, and
- D. Placement of soil materials in the closure cover. The closure cover consists of:

Top of Site

- foundation layer
- geosynthetic layers (geosynthetic clay liner, geomembrane, geonet, geotextile)
- vegetated soil layer

Site Side Slopes

- foundation layer
- geosynthetic layer (geosynthetic clay liner, geocushion)
- aggregate base layer
- concrete



- E. Contouring the north bank of the canal, the closure cover subgrade, the foundation layer, and the vegetated soil layer.

## 1.2 RELATED SECTIONS

- A. Section 02110 - Site Clearing.
- B. Section 02205 - Soil Materials.
- C. Section 02225 - Trenching.

## 1.3 QUALITY ASSURANCE

- A. The QC Engineer will be responsible for observing and documenting earthwork activities. The QC Engineer will obtain soil samples and perform tests to evaluate that the work is being performed in compliance with these Specifications. The QC Engineer will obtain soil samples and conduct tests on earthwork as outlined in Tables 02211-1 and 02211-2. The Contractor will provide assistance as necessary to accomplish the required sampling and testing.
- B. The following methods of field sampling and testing will be performed by the QC Engineer, as a minimum:
  - 1. In-place Density: ASTM D 2922
  - 2. Confirmation by Nuclear Gauge: ASTM D 2937
- C. The following methods of laboratory testing will be performed by the Engineer on soil samples, as a minimum:
  - 1. Particle Size Analysis: ASTM D 422 and ASTM D 1140
  - 2. Laboratory Moisture-Density Relation: ASTM D 1557
  - 3. Specific Gravity: ASTM D 854
  - 4. Permeability: ASTM D 5084
- D. Prior to placement, all materials must be approved by the QC Engineer according to the specifications contained in Section 02205. The suitability

of all materials will be determined by the QC Engineer by reviewing Contractor submittals and by conducting material evaluation testing as material is imported to the site in accordance with Table 02211-1.

- E. All material placement must be approved by the QC Engineer according to the specifications contained in this sections. The suitability of all material placement will be determined by the QC Engineer by conducting soil compaction testing in accordance with Table 02211-2. This does not relieve the Contractor of responsibility for adequate supervision and for installation of materials in compliance with these Specifications.
- F. During construction, the QC Engineer may direct that inspection trenches or test pits be cut into fills to determine that the Specifications have been met. Such trenches or pits will be of limited depth and size, and shall be backfilled with the material excavated therefrom, or other fill material meeting the requirements for the zones cut into. Backfill shall be compacted to a density at least equal to that specified for contiguous fills.
- G. When the QC Engineer directs inspection trenches or test pits to be excavated into fills and backfills, and materials are found to meet all Specification requirements, the excavation and refilling will be paid for as additional work pursuant to the California Department of Transportation (Caltrans) standard specifications, July 1992 or latest edition. Inspection trenches or test pits, and the refilling of the same will be at the Contractor's expense if it is found that the materials excavated do not meet the Specification requirements.

#### 1.4 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of utilities remaining, by type, diameter of pipe (if appropriate), horizontal location dimensions, elevations or inverts at specified location(s), and slope gradients.

## PART 2: PRODUCTS

### 2.1 MATERIALS

Not Used, see Section 02205.

## PART 3: EXECUTION

### 3.1 GENERAL

- A. Required lines, levels, contours, and datum will be identified by the Contractor before the start of earthwork operations.
- B. Material will be graded to the lines and grades shown on the Drawings
- C. Horizontal tolerances are plus or minus 0.1 foot. Vertical tolerances are plus or minus 0.1 foot.
- D. Make top surface of each layer smooth and level.

### 3.2 PREPARATION

- A. Identify required lines, levels, contours, and data.
- B. Identify known underground, aboveground, and aerial utilities. Stake and flag locations.
- C. Protect above- and below-grade utilities which are to remain.
- D. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.
- E. Verify that subgrade cut/fill balances.

- F. Each lift shall be thoroughly mixed to assure a uniform distribution of water content.
- G. No fill shall be placed during the rain or when saturation of the fill will hinder proper compaction.
- H. Jetting or flooding of the fill will not be permitted.

### 3.3 SUBGRADE EARTHWORK

#### A. Subgrade excavation

1. Where excavation is carried below the design grades, the Contractor will backfill to the required grade or to the indicated invert grade, as specified, and re-compact the backfill to 90 percent of the maximum dry density as determined by ASTM D 1557.
2. Unsuitable or low density subgrade material not readily capable of in-place compaction will be excavated as directed by the QC Engineer.
3. Excavation carried out for the convenience of the Contractor will conform the limits approved by the QC Engineer and will be at no additional expense to the Owner.
4. Upon reaching design excavation grades, on slopes 3:1 and flatter, the subgrade will be scarified a minimum depth of 6 inches and compacted to at least 90 percent of the maximum dry density as determined by ASTM D 1557.
5. The Contractor will conduct operations to prevent ponding of surface water within the limits of excavation and fill. Good drainage shall be maintained at all times. Ditches will be excavated at the locations shown on the Drawings to collect and transport storm runoff. All dewatering will be the Contractor's responsibility.

6. Stockpile areas and locations for burying of debris and unsuitable materials will be designated by the QC Engineer.
7. Any areas when topsoil is stripped shall be compacted to a minimum of 90 percent of the maximum dry density (as defined by ASTM D 1557) before any fill is placed.

B. Subgrade debris excavation

1. Excavate debris where necessary to reach subgrade elevations.
2. Excavated debris may be buried on site. Excavated debris must be buried at least 1' below closure cover design subgrade contours.
3. Excavated debris may be disposed of off site in a lawful manner. All sampling and chemical analysis of debris is the responsibility of the Contractor.

C. Subgrade fill construction

1. Excavated soils which are no larger than 3 inches in diameter may be used as fill to reach subgrade elevations. Excavation materials larger than 3 inches in diameter must be disposed of in accordance with Section 3.4.
2. Place and compact fill material in continuous layers not exceeding 6 inches compacted depth, compacted to 90 percent of the maximum dry density as determined by ASTM D 1557.
3. Fill materials shall be compacted to within 3 percent of the optimum water content as determined by ASTM D 1557.

### 3.4 FOUNDATION LAYER CONSTRUCTION

#### A. General Requirements:

1. Foundation layer materials will be placed to the lines and grades shown on the Drawings.
2. If any portion of the foundation layer materials does not meet the specified requirements, the Contractor will remove such material and replace with material meeting the specification requirements at no additional cost to the Owner.
3. During seasonal or extended shutdowns, all exposed surfaces will be protected from contamination which reduces permeability. Any contaminated materials will be removed and replaced at no additional cost to the Owner.

#### B. Placing Requirements:

1. Equipment used and placement method must be agreed upon and accepted by the QC Engineer prior to start of work. Approval does not absolve the Contractor of responsibility for damage to the site components. The Contractor is responsible for repairing damage to site components during foundation layer placement at no cost to the Owner.
2. Foundation layer materials will be placed in a manner to minimize disturbance to the underlying subgrade.
3. Place and compact foundation layer material in continuous layers not exceeding 6 inches compacted depth, compacted to 90 percent of the maximum dry density as determined by ASTM D 1557.

### 3.5 VEGETATED SOIL LAYER CONSTRUCTION

#### A. General Requirements:

1. Vegetated soil layer material will be placed to the lines and grades shown on the Drawings.
2. If any portion of the vegetated soil layer materials does not meet the specified requirements, the Contractor will remove such material and replace with material meeting the specification requirements at no additional cost to the Owner.

#### B. Placing Requirements:

1. Equipment used and placement method must be agreed upon and accepted by the QC Engineer prior to start of work. Approval does not absolve the Contractor of responsibility for damage to the geosynthetic components. The Contractor is responsible for repairing damage to site components during vegetated soil layer placement at no cost to the Owner.
2. Vegetated soil layer materials will be placed in a manner to minimize wrinkles to the underlying geosynthetics.
3. Place and compact the first foot of the vegetated soil layer material in one continuous lift, maintaining a minimum of 1 foot of soil under all equipment. Place and compact the remaining vegetated soil in a layer not exceeding 12 inches compacted depth. Compact to 85 percent of the maximum dry density as determined by ASTM D1557.

### 3.6 FIELD QUALITY CONTROL

- A. The QC Engineer will obtain samples and perform tests throughout the construction period. The Contractor will cooperate with the QC Engineer by providing access to testing areas and avoiding interference.

- B. The QC Engineer will perform tests or obtain samples to be sent to a laboratory for testing on a regular basis, as specified in Tables 02200-1 and 02200-2. These testing methods and frequencies are the minimum requirement. Additional tests may be performed at the QC Engineers's discretion.

Table 02211-1  
Material Evaluation Testing Frequency  
Per Source

ASTM Test Designation	Foundation Layer (CY)	Vegetated Soil Layer (CY)
422 (Particle Size)	5,000	5,000
1140 (Particle Size)	5,000	5,000
5084 (Permeability)	5,000	-
Minimum one test per material type Quarry certification required for foundation layer		

Table 02211-2  
Soil Construction Testing Frequency  
Per Source

ASTM Test Designation <sup>(1)</sup>	Foundation Layer (CY)	Vegetated Soil Layer (CY)
422 (Particle Size)	5,000	5,000
1140 (Particle Size)	5,000	5,000
5084 (Permeability)	5,000	-
2922 (Compaction)	1,000	2,000
(1) Minimum one test per material type		

### 3.7 STORM WATER CONTROL

- A. The Contractor shall implement such stormwater control measures as he as necessary, possibly including construction berms and pumping



stormwater to prevent contaminated stormwater runoff from flowing off site, to prevent stormwater runoff from accumulating in the construction area, to prevent erosion of or damage to the prepared subgrade, and to prevent damage to any emplaced geosynthetic or soil component.

## PART 4: MEASUREMENT AND PAYMENT

### 4.1 MEASUREMENT

- A. Measurement of subgrade cut and fill, foundation layer, vegetated soil layer will be on a cubic yard basis. Quantities will be computed by average-end-area methods based on data gathered from surveys conducted before and after construction and from lines and dimensions as shown on the Drawings.
- B. The measurement for Anchor Trenches, Stormwater Control, and shall be by lump sum basis.
- C. Separate measurements will not be made for the following items, and such work will be considered incidental to the related items of work:
  - 1. Dust control;
  - 2. Clearing and grubbing;
  - 3. Stripping topsoil and compacting;
  - 4. Excavation subgrade scarification and compaction;
  - 5. Temporary stockpiling of excavated materials;
  - 6. Rehandling of materials, if required;
  - 7. Dewatering; and
  - 8. Drainage control.

### 4.2 PAYMENT

- A. Payment for the items of Article 4.1.A and B will be by their applicable unit process per cubic yard or lump sum as quoted in the Bid Schedule. The prices quoted will include full compensation for excavating, hauling, placing

the materials and constructing the improvements as specified, and as shown on the Drawings. Progress payments shall be based on the amount of the work completed at the time of the invoicing.

- B. Separate payment will not be made for the items of Article 4.1.B. All costs for such work will be considered to be included in the prices quoted for the applicable related items of work.

END OF SECTION 02211

# Attachment 2

Proposed Change in  
Subgrade Specification



**IT Corporation**  
A Member of The IT Group

## **M E M O R A N D U M**

**To:** Bill Spedding, Project Manager

**Date:** 22 October 2001

**From:** Sunil Kishnani, PhD, PE 

**Subject:** Proposed Change in Subgrade Specifications  
Purity Oil Sales Site, Malaga, CA

### **Purpose**

This memorandum presents a proposal for an alternate specification for the prepared subgrade of the final cover system at the Purity Oil Sales Superfund Site in Malaga, CA. Current construction specifications require a compacted subgrade layer beneath the four feet of compacted cover (two feet of foundation layer and two feet of vegetative soil layer). The final cover system also consists of geosynthetic layers resulting in a composite cover system that is protective of human health and the environment.

### **Current Subgrade Specifications**

Current specifications for the subgrade beneath the foundation layer are presented in Section 02211 of the Construction Specifications. These specifications require that the subgrade be compacted to a minimum 90% of the maximum Modified Proctor dry density within 3% of the optimum moisture content in accordance with ASTM D 1557. All excavations and fill materials of the subgrade layer are required to meet the above requirements. The specifications require that the compaction of the subgrade layer be tested using insitu methods, specifically a portable nuclear density gauge.

In preparing the subgrade for acceptance, the Contractor (IT) has followed the procedures of compaction and testing as outlined in the Construction Specifications. Specifically, the slopes and the top deck have been track walked with a 750 John Deere LGP Bulldozer (a minimum of 4 passes), and compacted with a Ingersol Rand 84" Pad Foot Compactor (a minimum of 4 passes). In addition, a Volvo 120 Rubber Tire Loader (with a 4 cubic yard loaded bucket) has also been used for compaction of the subgrade in some areas. A majority of the nuclear gauge tests have failed to meet the project specifications. Some of the reasons of the failed tests are outlined below.

The subgrade at the Purity Oil site is predominantly comprised of contaminated soils; debris; mixed soils and debris; and mixed tarry waste materials, soils, and debris. The nature of the subgrade material makes testing compaction very difficult if not impossible. In typical earthwork projects, the compaction specification, e.g., 90% Modified Proctor, works well when the materials are uniform and free of debris and deleterious materials. If debris is present, like the case of the Purity Oil Site, the compaction specification becomes an inappropriate method of measuring the competency of the subgrade, especially with a nuclear gauge. The gauge method of measuring insitu moisture and density for a subgrade comprising of debris and oily contaminated soils is not an appropriate method because of the following:

1. The nuclear gauge will not be accurate in computing the total density if debris, especially rebar, is present. If the total density is inaccurate, the estimated compaction will be also inaccurate.
2. For petroleum contaminated soils, the nuclear gauge requires a moisture offset for each material type to measure an accurate moisture content. With the varying amounts of tarry materials and oil present, it becomes extremely difficult and cumbersome to estimate a consistent moisture offset for all materials encountered. If the moisture offset is inaccurate, the computed percent compaction will also be inaccurate especially since the total density is inaccurate as described in Item 1 above.
3. Due to the varying nature of the subgrade materials present, estimating a correct maximum Modified Proctor dry density in the laboratory for each material tested also becomes an issue of great significance. These material identification issues lead to inaccurate estimates of compaction and dry density.

In summary, the use of the nuclear gauge in conjunction with a subgrade containing debris and other heterogenous materials, results in a field verification procedure that is tedious, cumbersome, and oftentimes inapplicable. The purpose of this memorandum is to propose a more appropriate method of verifying subgrade competence which is feasible and efficient in terms of engineering performance and construction production.

### ***Proposed Alternate Subgrade Specifications***

Fortunately, it is unnecessary to determine the percent compaction of the subgrade materials in the field from a performance standpoint. The prime function of the subgrade is to provide a suitable even surface, free of depressions, on which the foundation of the cover system can be constructed. In typical landfill projects, the subgrade and the foundation layer are one layer which when prepared provides a competent base for the cover materials. This one layer is typically constructed from waste materials, regraded subsoils, or borrow materials as appropriate. Some recent DTSC-approved RCRA closure projects where the foundation layer beneath the geosynthetics is comprised of regraded and compacted waste materials are: 1) IT Vine Hill Complex Closure, Contra Costa County, CA, 1998; 2) IT Baker Closure, Contra Costa County, CA, 1998; and 3) IT Panoche Closure, Solano County, 2000. In comparison, the Purity Oil cover is comprised of a separate foundation layer, which is 2 feet of clean compacted material, and a separate compacted subgrade layer. This design is conservative because 2 feet of clean foundation soil is required below the geosynthetics in addition to a subgrade layer which can adequately provide this function.

A proposal is made to eliminate the compaction density and moisture testing requirements for the subgrade layer. The alternate specification proposed is a method specification requiring a minimum of 6 passes of a compactor (Ingersol Rand 84" or other approved equivalent) for the entire subgrade layer. The foundation layer when compacted above the subgrade layer will be tested for compaction per the specifications and will give an indication of the competency of the subgrade layer. It is much more appropriate to measure compaction, especially with a nuclear gauge, in a clean uniform foundation material than the subgrade which is heterogenous and mixed in nature. The subgrade will then have an indirect specification which will be measured by the compaction of the foundation layer above it. If consistent passing tests are observed in the 2 feet of foundation material, then the subgrade is competent and the need to measure its percent compaction is unnecessary and irrelevant.

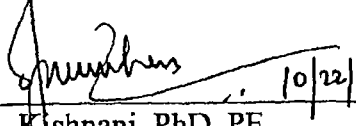
The details of the proposed alternate specification for the subgrade layer are as follows:

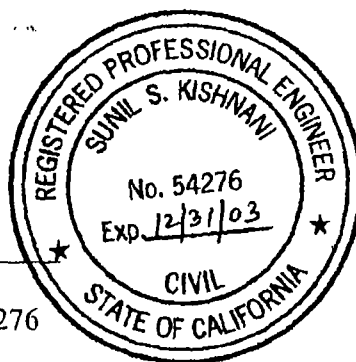
1. Minimum six (6) passes of a compactor (Ingersol Rand 84" or other approved equivalent)
2. Adjacent passes shall be overlapped by a minimum of 1 foot
3. Loose or soft areas as determined by the QC Engineer will be reworked and recompactd
4. Continuous visual inspections by the QC Engineer during compaction
5. Daily documentation during compaction
6. Survey of the approved subgrade layer

### Conclusion

A more appropriate and streamlined specification is proposed for the subgrade layer of the final cover system at the Purity Oil Sales Superfund Site project in Malaga, CA. The competency of the subgrade layer is determined indirectly by measuring the compaction of the foundation layer supported by the subgrade layer. It is proposed to eliminate the compaction specifications for the subgrade layer and replace them with a method based specification requiring a minimum of 6 passes of a compactor. This proposed change will result in the same quality of the final product as the original specification. The need to measure the compaction of the subgrade for acceptance is unnecessary and inefficient. This change will increase production in the field without compromising the quality of the final product.

Prepared by:

  
Sunil S. Kishnani, PhD, PE  
California Registered Civil Engineer, C54276  
Expires 12-31-2003



RECEIVED  
10/24/01

October 24, 2001

Mr. Mark Lewis  
Tetra Tech EM Inc.  
9107 Bluebonnet Centre Blvd. Ste. B  
Baton Rouge, LA 70809

**RE: Purity Oil Sales Superfund, Fresno, California**

**Subject: RFI No. 28 Perimeter Slope Sub-grade Solidification Procedure**

Dear Mr. Lewis,

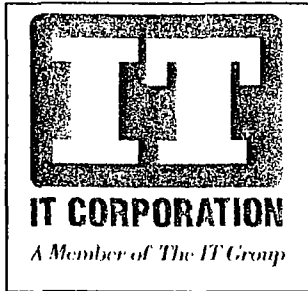
SECOR is forwarding a copy of the perimeter slope subgrade solidification procedure for your review on behalf of Chevron, from the IT Corporation.

If you have any questions please call me at (517) 202-5617.

Thanks,

Scott Jordan

SECOR International Incorporated



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## REQUEST FOR INFORMATION

RFI NO. 28
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October 24, 2001

TO: Mark Lewis  
FOR: Tetra Tech EM Inc.  
Tel: (559) 486-1695

**JOB: PURITY OIL SUPERFUND SITE PROJECT**

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**Subject: Perimeter Slope Subgrade Solidification Procedure**

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### **Current Requirement:**

No current requirement exists.

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### **Proposed Change:**

See attachment 1 for operational procedural details.  
See attachment 2 for QC procedural details.

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### **Technical Justification for Proposed Change:**

See attachment 1 for details.

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**DATE THE ABOVE INFORMATION IS REQUIRED: October 29, 2001**

***SEE ATTACHMENT 1 FOR STAMPS AND SIGNATURES***

By: Sunil S Kishnani, PhD, PE  
Kenneth S Obenauf, PE

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Comments:

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EPA Approval:

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Name (print)	Signature	Date
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**RFI 28 - Perimeter Slope Subgrade Solidification Procedure**

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# Attachments

# Attachments

1. Perimeter Slope Subgrade  
Solidification Procedure
2. Perimeter Slope Subgrade  
Solidification QC Procedure
3. Purity Oil Superfund Plan View
4. MSDS for Quicklime, CaO, Lime

# Attachment 1

## Perimeter Slope Subgrade Solidification Procedure

### Perimeter Slope Subgrade Solidification Procedure Purity Oil Superfund Site

Due to the presence of soft tarry waste, contaminated soil material, iron, steel, and large concrete construction debris in the subgrade, "soft" spots have been observed on the subgrade of the perimeter slope. Also due to the presence of these materials it has been difficult to accurately test the compaction of the subgrade.

Based on discussions between representatives of EPA, Tetra Tech, SECOR (10/17/01 only), and IT Corporation, on October 15 and 17, 2001, the following procedure was developed to address the solidification of soft areas on the perimeter slope.

The procedures will be verified and if necessary modified depending on the results of two test areas. The first test area will be an insitu mixing area directly on the slopes. The second test area will be on the top of the slopes where the slope material will be excavated to the required depth, moved to the top of the slope, mixed with lime, then placed back on the slope for compaction and grading.

The following protocol is proposed for the solidification:

1. Areas requiring treatment are grids F thru X on the North Slope and grids N thru T on the South Slope as shown on the attached Figure. If any further areas require treatment, it will be jointly determined by the EPA, Tetra Tech, SECOR, and IT.
2. The identified areas of the perimeter slope will be cleared to a depth of approximately 2 feet for rebar, pipe, and large debris (greater than 12 inches in size) that could impede the solidification process. Also approximately 200 feet of the western end of the Northern Slope will be cleared of large debris up to a depth of approximately 3 feet. The rippers on the dozer will be set to the appropriate depth.
3. Lime will then be added to the soil waste material at a minimum rate of 10% by total weight of the mixed material. More or less quantity of lime may be used, depending on the test area results. (At 10% rate, approximately 17 tons of lime will be required per grid [ $115 \text{ lbs/ft}^3 \times 2 \text{ ft deep} \times 50 \text{ ft grid length} \times 30 \text{ ft slope length} \times 10\% \div 2,000 \text{ lbs/ton} = 17.25 \text{ tons}$ ]). The lime will then be mixed in place with the existing soil and waste material using an excavator bucket.
4. The lime and soil will be mixed with the excavator until an adequate mixture has been achieved. Water will be added as needed to control dust and assist with the mixing.
5. The lime and soil mixture will then be graded in accordance with the grading plan, compacted using a minimum of 6 passes with a compactor, and then allowed to "set" for a minimum of 3 days.
6. Construct the Foundation Layer in accordance with the Construction Specifications.

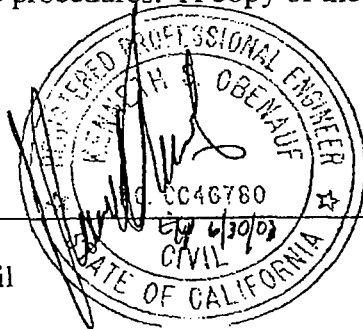
The additive mixing will be done with an excavator, under controlled procedures and with a dedicated fire watch. This procedure should keep the exothermic reaction within controllable limits. The solidification process stiffens the waste by removing the water in a chemical reaction with calcium oxide. This solidification process hardens the waste. The key to successful solidification with lime is to manage and dissipate the exothermic heat of reaction. The heat of reaction is rarely immediate and often has a lag time of 5 to 15 minutes before the heat rise is apparent. Once the heat rise begins, it can last for several hours, though it typically lasts for 1-2 hours. The heat rise can be controlled by several methods:

- by limiting the amount of additive used with a fixed amount of soil
- by mixing more soil with a fixed amount of lime
- by mixing additional water with the soil/lime blend

The hazards associated with the solidification process are primarily dust and vapor emissions. Though the lime utilized will be pebble-sized (3/8" to 1/8"), some dust may be associated with the pebbles. The mixing of the waste material has the potential to release organic vapors and the heat of reaction for the calcium oxide and water may increase that potential. Air monitoring will be utilized around the solidification activities to ensure the operations do not generate excessive fugitive gases outside the work area. In the event, one of these constituents exceeds an acceptable limit the solidification activities will cease until the condition has been corrected. The heat of reaction from the calcium oxide and water; combined with the organic nature of the waste material; can pose a fire hazard. A fire watch will monitor all solidification activities to assist the operator as needed. The water truck will be available during this operation. All personnel will review these procedures. A copy of the material's MSDS is attached.

Prepared by:

Kenneth S. Obenauf, PE  
Project Engineer, Purity Oil  
IT Corporation



Concur:

23 OCT 2001  
Sunil S. Kishnani, PhD, PE  
Quality Assurance Engineer, Purity Oil  
IT Corporation



RECEIVED  
APR 23 2002

**SECOR International Incorporated**

**RFV No. 01**

**REQUEST FOR VARIANCE**

**RFV No. 01**

**April 22, 2002**

**TO:** Mark Lewis, Tetra Tech EM Inc. **PHONE:** (559) 486-1695

**cc:** Rose Marie Caraway, USEPA Region IX

**RE:** Purity Oil Sales Superfund Site OU-2  
Perimeter Slope Solidification Procedure (RFI #28 Revision 3)

SECOR International Incorporated (SECOR) is requesting a variance to the Perimeter Slope Sub-grade Solidification Procedure as presented in RFI #28 Revision 3, which was submitted by the IT Corporation and subsequently approved by the United States Environmental Protection Agency (USEPA). As no previous requirement exists in the Consent Decree (CD), 100% Final Design (FD) or Statement of Work (SOW), SECOR has reviewed all available information generated by the previous contractor, which includes the following documents: RFI #28, RFI #28 Revision 1, RFI #28 Revision 2, RFI #28 Revision 3, USEPA comments which address these documents, and a summary of the previous contractor's attempts to stabilize the slopes.

In evaluating the Portland cement stabilization method, SECOR has found evidence that this method will not be effective at the Purity Site. An EPA demonstration using Portland cement for stabilization of acidic petroleum sludges at the Douglassville Superfund Site in Pennsylvania failed to adequately stabilize the sludge and the Record of Decision (ROD) was changed to allow for quicklime stabilization. The Portland cement method attempts to stabilize sludge by creating micro-cementation, which produces a temporary strength for undisturbed sludge, but the sludge will turn flowable when mixed or disturbed. Therefore, SECOR evaluated using quicklime to stabilize the Purity sludge. Quicklime treatment works by chemical stabilization reactions as opposed to micro-cementation bridges that are destroyed when agitated. Quicklime treatment has been used successfully by SECOR at other sites for the stabilization of petroleum-impacted soils and sludges.

Upon becoming the supervising contractor, SECOR conducted bench-scale tests to evaluate quicklime as a stabilizing agent that would address the concerns associated with this task, specifically, establishing a surface capable of supporting the closure cover, reducing the acidic nature of the tarry waste to help eliminate impacts to the liner materials, and limiting the mobility of the waste materials.

#### **RATIONALE FOR QUICKLIME STABILIZATION**

SECOR's geochemistry laboratory received one-gallon samples of soil and sludge from the Purity Oil Site on April 19, 2002, and completed stabilization testing on the materials. Samples of the soil and sludge were both tested for percent moisture. The soil consisted of a dry, fine sand and had a percent moisture of four percent. The sludge consisted of a sticky, low-molecular weight, sulfonated

hydrocarbon tar. The percent moisture of the sludge ranged from 16 to 23 percent and the pH ranged from 0.7 to 1.3.

SECOR performed neutralization tests on the sludge to determine the amount of quicklime required to react with the sulfonated hydrocarbons and raise the pH above 7.0. If the pH is greater than 7.0, the sulfonated functional groups on the sludge have been sufficiently neutralized. These sulfonated functional groups are largely responsible for the flow of the material, because desulfonation and subsequent hydration reactions give the sludge the energy it needs to flow. Neutralization turns the sulfonated hydrocarbons into plain tar, and mixing the tar with an adequate amount of soil turns the tar into asphalt. Therefore, pH is the best indicator of success for stabilization. Density/moisture relationships for compaction are unreliable, because the quantity of hydrocarbon in the stabilized mixture is inversely proportional to the density, and the ratio of sludge to soil will vary significantly (although it should be maintained at less than 20 percent sludge in soil). Also, the hydrocarbons will interfere with moisture analyses.

Quicklime was added incrementally to the sludge while the pH was monitored. The pH of the sludge increased to 1.7 with 10 percent quicklime addition, to 2.5 with 20 percent quicklime addition, and to 7.8 with 30 percent quicklime addition. Therefore, 30 percent quicklime addition was selected as a conservative addition amount for successful neutralization.

After treatment with 30 percent quicklime, the sludge retained its tarry consistency due to the low molecular weight tars. This type of sludge can generally only be stabilized by adding a sufficient binding agent to the sludge at four to five times the mass of the sludge. Therefore, four parts soil was added to each one part of neutralized sludge and mixed until the material was uniform. This type of sludge requires mixing the sand into the sludge, rather than mixing the sludge into the sand.

After mixing the sludge and soil at four parts soil to one part neutralized sludge, the material was compacted into a metal container and placed sideways onto a heat plate to determine if the treated material would take on flow characteristics when heated. The temperature of the neutralized sludge/soil mixture was raised to 400 ° F, and the material remained in place as a compact material. This confirmed that the neutralized mixture was suitably stabilized.

In general, this testing showed that to stabilize the sludge, the sludge must be neutralized with 30 percent quicklime by weight and then mixed with soil at a ratio no less than four parts soil to one part sludge. A two-foot thick layer of neutralized/stablized sludge and soil should be placed and compacted on the slopes to achieve the stabilization goals (establishing a surface capable of supporting the closure cover, reducing the acidic nature of the tarry waste to help reduce impacts to the liner materials, and limiting the mobility of the waste materials).

### **RECOMMENDED FIELD PROCEDURE**

Based on the results of the bench-scale testing, SECOR proposes stabilization of the perimeter slopes using quicklime, in conjunction with an effective dust control plan. SECOR's initial approach will



be to excavate a pit and install plastic-covered framework around the excavation. The framework will be constructed tall enough for an excavator to operate within an opening of the enclosed area. The quicklime mixing and stabilization will then be conducted within the protected area. This method will eliminate any fugitive dust problems. During these activities, SECOR will conduct both on-site and off-site air monitoring.

Several factors were assessed to help eliminate any fugitive dust problems:

- **Number of Mix Areas** Although multiple mix areas would increase the rate at which the slopes could be stabilized, SECOR's initial approach would be limited to one area. This approach will allow for more control of the process in all aspects, such as dust control, air monitoring, quality control, and supervision. Upon successful operation of the single mix area, more areas may be added.
- **Proximity to the Slopes Requiring Stabilization** SECOR will place the mix area in a location along the west end of the Site to help minimize both the distance the soil will have to be transported, as well as the impact to the surrounding neighbors.
- **Size and Depth of the Mix Area Excavation** SECOR will excavate an area approximately 10' x 15' x 5' deep. The size of the mix area was determined by the area needed to conduct mixing activities within the confines of the constructed dust enclosure.
- **Construction of Dust Enclosure** SECOR will erect framework around the perimeter of the excavation to a height of approximately 20 feet, and then cover the framework with a layer of Visqueen<sup>TM</sup>, or equivalent, to form walls around the mix area. The Visqueen<sup>TM</sup> will be inspected on a daily basis for wear or tears and replaced as necessary.

The mix area will be constructed so that one end remains partially open to allow room for the cab and boom of the excavator to enter the mix area, as well as to allow for the dumping and loading of quicklime and soils. The open end will be located opposite that of the normal prevailing wind direction, based on available air monitoring data, to help minimize any dust emissions.

During the slope soil removal process, as well as during all mixing activities, a water truck with odor suppressant material will be available to help provide dust and odor control.

- SECOR will remove the soils from the perimeter slopes to the pre-determined depths using an excavator. As the soils are removed from the slope, they will be visually assessed for the criteria below and should they require mixing, the soils will be loaded into a truck and transported to the mix area.

- Pelletized quicklime, which will be stockpiled adjacent to the mix area on a daily basis, will be used to stabilize the sludge. The use of pelletized quicklime, as opposed to quicklime fines, will significantly reduce fugitive dust emissions during delivery to the site. After the sludge is stabilized the appropriate amount of soil will be added to the sludge.

Based on the objectives defined above and RFI #28 Revision 3, SECOR will excavate the perimeter slopes, which include the areas beginning with the north slope at Grid F-5 and continues through Grid F-2 on the south slope. The slopes to be stabilized are shown on Figure 1. The grid dimensions are roughly 50-feet by 30-feet. The slopes will be excavated to a depth of 2 feet and the soils removed will be visually assessed for the following criteria, on a grid-by-grid basis.

1. Does the soil removed contain deposits of tarry waste large enough to fail one of the initial objectives? If yes, the soil will be transported by truck to the mix area and stabilized. If no, the soil will be replaced on the perimeter slope in lifts, compacted, and tested for compressive strength.
2. If significant pockets of tar or sludge are encountered below the excavation, a one-inch thick layer of pelletized quicklime will be placed over any visible sludge before backfilling. This will create an alkaline barrier between the sludge and the stabilized material.
3. Soils requiring stabilization will be mixed with quicklime. The amount of quicklime that will be added to the soils will be based on the estimated weight/volume of tarry waste contained within the soil (not the weight of the soil). The mass of sludge in the excavated soil will be estimated based on standard engineering equations (i.e., the excavated area multiplied by the thickness of the sludge layer, assuming a sludge density of approximately 75 to 80 pounds per cubic foot). Once the mass of sludge in the excavation volume is determined, 30 percent of that mass will be added as quicklime (in pelletized form, to reduce fugitive dust emissions).

The following field calculation should be performed to estimate the quicklime:

$$\text{Quicklime (pounds)} = V_{\text{sludge}} \times 75 \text{ lb/ft}^3 \times 0.30$$

Where:  $V_{\text{sludge}}$  = sludge length x sludge width x average sludge thickness  
75 lb/ft<sup>3</sup> = sludge density  
0.30 = 30% quicklime

4. After mixing the quicklime, sludge, and soil, a 10 gram sample of the mixture will be placed into 100 milliliters of distilled water, mixed thoroughly, and tested for pH. The amount of quicklime added to the sludge will be considered adequate when the mixtures obtain a pH between 7.0 and 12.5. This pH range was chosen since it is

critical not to under-dose the sludge, and there is no danger in having additional hydroxide to neutralize underlying soils. Because of the low solubility of quicklime, the pH will not exceed 12.5 regardless of the quantity added.

5. After confirming a mixture pH between 7.0 and 12.5, the material will be transported back to the slope, placed, and compacted with a compactor. The compacted soil will then be tested in-place. A pocket penetrometer will be used in lieu of a density/moisture analyses, since the native soils should achieve better than 15 psi (1.1 tons/ft<sup>2</sup>) when compacted, and the sludge will only achieve this value if sufficiently stabilized. Should any soils that have been placed onto the slopes fail to achieve 15 psi, the area will be re-compacted and tested again with the pocket penetrometer. If a second penetrometer test fails, the material will be re-excavated and additional quicklime will be added within the mix area as detailed in Step 3 above.

### QUALITY CONTROL PROCEDURES AND OBSERVATIONS

The following Quality Control Procedures will serve as a supplement to the *Construction Quality Control Plan for Remedial Actions on Operable Unit Two (OU-2), Purity Oil Sales Superfund Site* to address the issue of slope stabilization with quicklime. The QC Engineer should review the procedure presented above and use the following questions and tests as a guideline for completing the Slope Stabilization Logs (see Attachment 1).

*Prior to removing any soil from the perimeter slopes:*

- Record the slope (N, S, SW, or W), grid location, date, and time.
- Record the appearance of the soil.

*During the excavation of the slope soils:*

- Record the depth of the excavation as measured from the sidewall of the slope.
- Record the presence or absence of pockets of sludge, along with approximate volumes.
- Record the amount of soil/sludge that is transported to the mix area.

*During the mixing procedure:*

- Record the approximate volume of quicklime added to the sludge.
- Record the amount of soil added to the quicklime/sludge mixture.
- Conduct pH measurements on the mixture and record results (pH tests should be between 7.0 and 12.5).

*During re-placement of soils along the slopes:*

- Record the lift thickness of the soils being placed (not to exceed 1 foot).
- Verify that soils are compacted.
- Conduct and record compressive strength test results, minimum 4 tests/grid (results should be >15 psi)
- Confirm that no seeps exist or re-occur.

*Corrective Actions:*

- Should any pH test results fail to meet the criteria outlined above, additional quicklime will be added to the mixture until the pH of the mixture falls within the specified range.
- Should compressive strength test results fail to meet the criteria specified above the area will be re-compacted and re-tested. If an area still fails compressive strength testing after sufficient effort has been applied to re-work and re-compact the soil, the area shall be re-excavated and additional quicklime will be added.

*Field Equipment*

The pH testing will be completed with an Oakton pHTestr meter, or equivalent pH meter.

A pocket penetrometer will be used to measure the compressive strength of the stabilized soil mixture.

**STABILIZATION SCHEDULE**

The slope stabilization activities are currently scheduled to be conducted during the hours of 7 a.m. to 5:30 p.m., 10 hours per day, 6 days per week. The stabilization work is anticipated to be completed in approximately 3.5 weeks, dependent upon the weather. A complete project schedule, including dates for slope stabilization, will be included in the RAWP Addendum.

At least 24 hours prior to beginning these activities, a quarter-page article will be printed in the local newspaper announcing the slope stabilization work to be conducted at the Purity Oil site. A copy of the proposed newspaper article is included in Attachment 2.

**HEALTH AND SAFETY SUPPLEMENT**

The perimeter slope stabilization activities to be conducted will require implementation of health and safety protocols in addition to those presented in the *Health and Safety Plan for Remedial Action on Operable Unit Two (OU-2)* (HASP). The soil and sludge will heat up significantly during stabilization due to the exothermic reaction with quicklime. Therefore, care will be taken to prevent contact with the skin to prevent burns. Although sulfur dioxide and hydrogen sulfide were not detected during the bench-scale tests, they could be trapped in micro-voids within the sludge and be released from the sludge during the mixing process (although the stabilization process itself does not create these gases). In addition, concerns regarding potential for off-site impacts will require both on- and off-site air monitoring during stabilization activities.

This supplement addresses the issues presented above, and provides procedures that are to be implemented in addition to the procedures presented in the HASP.

*Project Personnel***Construction Personnel**

During the stabilization activities, SECOR will have two site health and safety officers (SHSOs) to conduct air monitoring both on- and off-site. The on-site SHSO will perform air monitoring in the vicinity of the excavation and mixing pit, as well as the site perimeter. The off-site SHSO will perform air monitoring at the downwind property.

Prior to commencing stabilization, the prevailing wind direction for the previous one-hour interval recorded by the site meteorological station will be identified, and the location for off-site monitoring will be based upon that wind direction. During stabilization activities, the on-site SHSO will make observations of the on-site wind sock station to determine if a change in off-site monitoring is required. If a change in location is required, the on-site SHSO will communicate the modification via radio/telephone with the off-site SHSO so that off-site air monitoring will be conducted at the appropriate downwind location.

**Subcontractors**

The only subcontractor that will be involved with the perimeter slope stabilization activities is the quicklime transporter. To prevent potential contaminant exposure by the truck drivers, stabilization activities will be suspended while the quicklime deliveries are being made. Once truck drivers have left the site, stabilization activities will resume.

*Chemical Hazards*

The information presented below is provided as a supplement to the information included in the HASP. Table 1 presents the appropriate action levels and response actions required for the stabilization activities.

**Quicklime**

Quicklime (calcium oxide, CaO) is a caustic material that is corrosive to skin and can potentially cause severe damage. The most common quicklime injuries result from quicklime dust entering the eyes of workers, especially when the material is dumped from trucks. Pelletized quicklime will be used to minimize exposure to dust during delivery to the site. Another common injury occurs in the form of mild skin burns and abrasions around the collar and cuffs of people working with the material. This injury is caused by quicklime dust entering breaks in the clothing, contacting the skin and reacting with perspiration from the body. The reaction with water creates heat, which slowly burns the skin with time. When inhaled, quicklime dusts can also damage tissue in the respiratory tract.

**Sulfur dioxide**

Sulfur dioxide (SO<sub>2</sub>) gas is a poison to humans by inhalation. It is an eye, skin, and mucous membrane irritant and can be corrosive to tissue. It primarily affects the upper respiratory tract and bronchi. The gas is irritating to humans and provides its own warning of toxic concentrations. Sulfur dioxide causes a coughing and choking sensation, and at low exposures levels may cause a temporary inflammation of the breathing passage, resulting in a wheezing sensation and shortness of breath. A choking sensation, random coughing, and unpleasant stinging of the mucous membranes may be observed by individuals working with sulfur dioxide at concentrations less than 5 ppm.

**Hydrogen Sulfide**

Hydrogen sulfide (H<sub>2</sub>S) gas is typically easily detected at low concentrations due to its characteristic odor of rotten eggs. However, long term exposure to the gas can fatigue the sense of smell, causing workers to become unaware of inhalation hazards even when they are exposed to high concentrations. The sense of smell should not be relied upon for hydrogen sulfide detection. Hydrogen sulfide is an irritant to the eyes and mucous membranes and is a poison by inhalation.

*Physical Hazards***Dust**

Procedures for dust control will be implemented according to the HASP. Additional preventative measures will be used to minimize generation of dust and off-site dust migration during slope stabilization. Pelletized quicklime will be delivered to the site to minimize the amount of dust generated during delivery of quicklime, and a dust enclosure will be constructed around the mix area to prevent off-site migration of dust. A water truck containing odor suppressant will be available for dust control outside the contained mix area.

*Personal Protective Equipment*

Slope stabilization activities will be completed with personnel wearing Level C personal protective equipment (PPE). When Level C PPE is required, chemical cartridges will be combined with HEPA filters to limit inhalation of particulates. Once sufficient air monitoring data (minimum two days of data) has been generated, PPE may be down-graded to Modified Level D if monitoring data deem Level D appropriate. Modified Level D will be required to prevent skin contact with quicklime.

*Site Monitoring*

Real-time air monitoring will be conducted both on- and off-site during slope stabilization activities. On-site monitoring will be conducted near the stabilization area, and off-site monitoring will be

conducted outside the perimeter fence at the downwind property. The real-time air monitoring will be conducted in accordance with the HASP.

Perimeter air monitoring will be conducted in accordance with the *Perimeter Air Monitoring and Sampling Plan, Operable Unit Two (OU-2), Purity Oil Sales Site*.

*Emergency Response Plan and Contingency Procedures*

In the event of an emergency during the slope stabilization activities, procedures documented in the HASP will be implemented. Due to the potential for off-site impacts as a result of slope stabilization activities, the Project Manager (PM) will contact representatives from each adjacent property to notify them of the stabilization activities.

In the event that odor or dust complaints are received during slope stabilization activities, SECOR will immediately suspend operations and apply water/odor suppressant material. Once activities resume, real-time air monitoring will be conducted at the location of the complaint origin to provide documentation that appropriate health and safety action levels are not exceeded.

If real-time air monitoring data indicate that action levels at off-site, downwind properties cannot be met, the slope stabilization process will be reviewed to determine if additional measures can be implemented to control dust and/or contaminant migration. If additional dust/contaminant migration control measures are not available, slope stabilization activities will be conducted at night.

***Requested By:***

Jeremy M. Rasmussen, P.E.  
QA Engineer  
Phone: (517) 349-9499 ext. 31  
Fax: (517) 349-6863  
Cell: (517) 202-7633  
Home Office: (810) 245-5807  
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**Table 1**  
**Action Levels for Slope Stabilization**

Analyte	Action Level <sup>1</sup>	Required Action <sup>2</sup>
---------	---------------------------	------------------------------

**Level D PPE<sup>4</sup>**

Dust	> 0.5 mg/m <sup>3</sup> above background (total dust) > 0.5 mg/m <sup>3</sup> above background (PM10)	Efforts will be made to suppress dust; if ineffective, personnel will upgrade to Level C
VOCs	>0.5 ppm above background, <50 ppm ≥50 ppm	Detector tube for Benzene, continue if no benzene detected Upgrade to Level C PPE
Benzene	>1 ppm, <5 ppm ≥5 ppm	Stop work, contact CIH <sup>3</sup> Stop work, determine cause <sup>3</sup>
O <sub>2</sub>	>23.5% or <20%	Stop work, determine cause <sup>3</sup>
LEL	≥10% LEL	Stop work, determine cause, evaluate ventilation
H <sub>2</sub> S	>5 ppm, <10 ppm	Stop work, ensure exposure < 10 ppm before resuming
SO <sub>2</sub>	>2 ppm, <5 ppm	Stop work, ensure exposure < 5 ppm before resuming

**Level C PPE<sup>4</sup>**

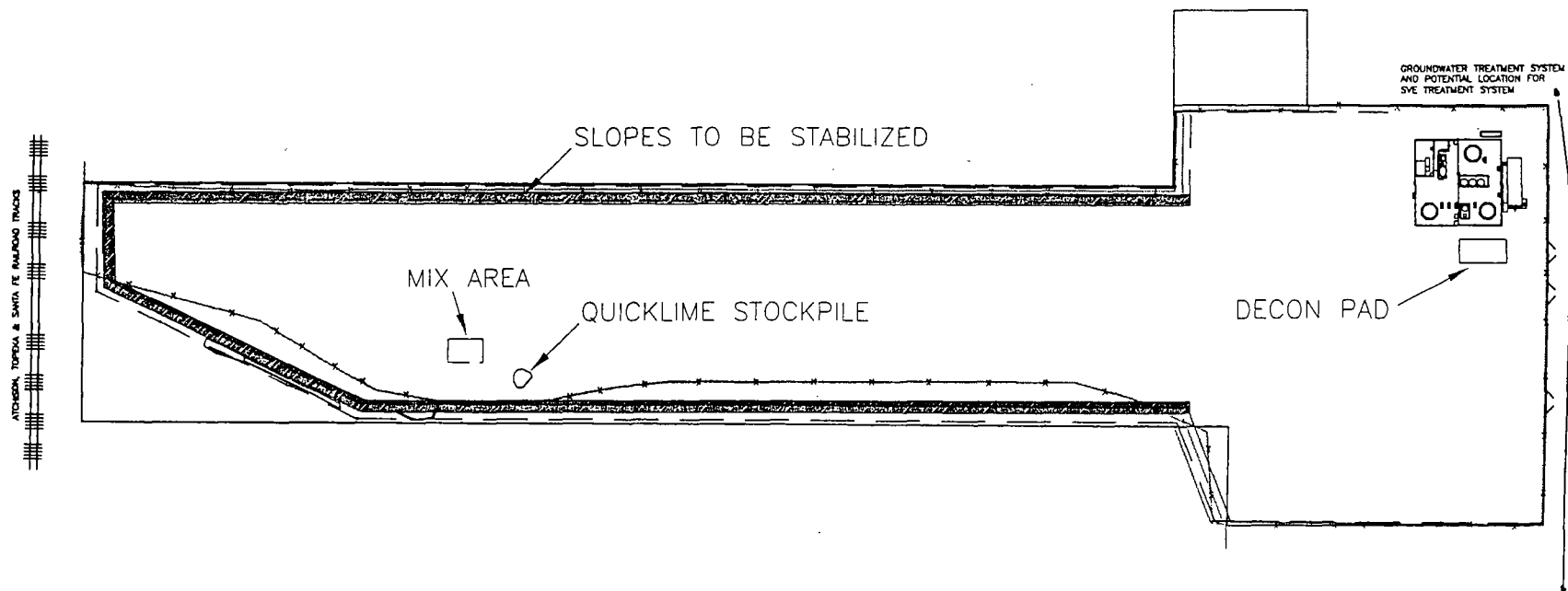
Dust	> 5.0 mg/m <sup>3</sup> above background (total dust) > 5.0 mg/m <sup>3</sup> above background (PM10)	Stop work, initiate dust suppression <sup>3</sup>
VOCs	>50 ppm above background in breathing zone, <100 ppm	Stop work, detector tube for Benzene, if no benzene detected continue in Level C PPE <sup>3</sup>
Benzene	≥5 ppm, <50 ppm	Upgrade to Level B PPE, contact CIH
O <sub>2</sub>	>23.5% or <20%	Stop work, determine cause <sup>3</sup>
LEL	≥10% LEL	Stop work, determine cause <sup>3</sup>
H <sub>2</sub> S	≥10 ppm	Stop work, determine cause <sup>3</sup>
SO <sub>2</sub>	≥5 ppm	Stop work, determine cause <sup>3</sup>

**NOTES:**

During slope stabilization activities, personnel will be required to wear Level C PPE initially. After sufficient air monitoring data has been collected (minimum 2 days), PPE may be downgraded to Modified Level D PPE.

- <sup>1</sup> Five exceedances of the action level within any 15-minute period, or a sustained reading in excess of the action level for 5 minutes will trigger a response.
- <sup>2</sup> Monitoring may be adjusted by the CIH, with the EPA's concurrence, after sufficient characterization of site contaminants has been completed, tasks have been modified, or site controls have proven effective.
- <sup>3</sup> Contact with the Project Health and Safety Manager (CIH) must be made prior to continuance of work. The CIH may then initiate integrated air sampling along with additional engineering controls.
- <sup>4</sup> No one is permitted to downgrade levels of PPE without authorization from the CIH.





**FIGURE 1**  
**SLOPE STABILIZATION LAYOUT**

**PURITY OIL SALES SITE  
STEERING COMMITTEE  
FRESNO, CALIFORNIA**

**SECOR**

2321 CLUB MERIDIAN DRIVE  
SUITE E  
OKEMOS, MICHIGAN 48864

DWN	DRM
APPR	
DATE	4/22/02
JOB NO.	24CH.67001

**ATTACHMENT 1**  
**SLOPE STABILIZATION FIELD LOGS**

## Stabilization Log Initial Excavation

**Project Name:** Purity Oil Superfund Site

Project Number: 24CH.67001

Location: Fresno, California

[illegible]

## Stabilization Log

### Mixing

**Project Name:** Purity Oil Superfund Site

Project Number: 24CH.67001

Location: Fresno, California

[illegible]

\* Amount of Quicklime =  $\text{Volume}_{\text{sludge}} \times 75 \text{ lb/ft}^3 \times 0.30$

★ ★ Minimum Ratio of 4:1

## Stabilization Log

### Compaction

**Project Name:** Purity Oil Superfund Site

Project Number: 24CH.67001

Location: Fresno, California

[illegible]

**ATTACHMENT 2**

**PUBLIC NOTICE FOR SLOPE STABILIZATION ACTIVITIES**



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION IX  
75 Hawthorne Street  
San Francisco, CA 94105

**PUBLIC NOTICE**  
**CLEAN-UP ACTIVITIES FOR PURITY OIL SALES SUPERFUND SITE**  
**3281 SOUTH MAPLE AVENUE, MALAGA TOWNSHIP, CA**

USEPA is providing notification of schedule changes affecting remedial work to be completed at the Purity Oil Sales Superfund Site, a former waste oil processing facility, located in the township of Malaga at 3281 South Maple Avenue, Fresno County, Fresno, CA. The clean-up activities will consist of stabilizing the waste oil contaminated soil along certain perimeter slopes. The work is to be conducted during the hours of **7:00 am to 5:30 pm** between **May 6, 2002 and July 6, 2002**.

The Purity Oil Sales Superfund Site refined petroleum waste oils at the seven-acre site between 1934 and 1975. Oil and by-products from the refining process were collected and stored in sumps, storage tanks, and sludge pits. Waste oil sludge was used by local farmers for dust control or buried in unlined pits and ponds, contaminating soil and groundwater. Soils at the sites are contaminated with phenols, polychlorinated biphenyls, pesticides, oil and grease, volatile organic compounds, lead, copper and zinc. The soil clean up involves removing contaminated vapors from the soil and capping the lead and waste oil contaminated soil. The groundwater is contaminated with volatile organic compounds and heavy metals including iron and manganese. The groundwater treatment system, which strips contaminants in groundwater, has been in place since 1995.

The United States Environmental Protection Agency is overseeing the remedial activities conducted at this site under the Superfund Program.

**Any question or comments regarding this project should be addressed to:**

**Rose Marie Caraway**  
**United States Environmental Protection Agency**  
**Region IX**  
**74 Hawthorne Street**  
**San Francisco, CA 94105-3901**

**Phone: (415) 972-3158**  
**Local: (559) 486-1695 (Daytime)**  
**(800) 971-6810 (Pager)**  
**(800) 971-6811 (Pager)**

**BENCH SCALE SOLIDIFICATION REPORT  
FOR SULFONATED SLUDGE IN SIDE SLOPE SOILS**

**PURITY OIL SALES SUPERFUND SITE,  
FRESNO COUNTY, CALIFORNIA**

Testing performed:  
April 22, 2002

Prepared by:  
SECOR International Inc.  
2321 Club Meridian Drive, Suite E  
Okemos, MI 48864



## 1.0 DESCRIPTION OF PROBLEM

A high-density polyethylene liner will be placed over hydrocarbon-impacted soils at the Purity Oil Site in Fresno, California as part of the remediation program. Sulfonated tars have been observed to seep from some portions of the slope where the liner is to be placed. The tar seeps are affecting the compaction strength of the soils in the vicinity of the seeps due to reduced density and higher moisture content. Prior testing by I.T. Corporation indicates that the sulfonated tar has a pH of 1.3 with a moisture content of 16 percent. I.T. Corporation proposed the use of a wet cement mix containing 40 percent water by weight to neutralize and solidify the slope. This is equivalent to a 0.7 water-to-cement ratio, which is close to the maximum water content that a cement can hold. I.T. Corporation proposed to add the wet cement to the soils at a ratio of ten percent wet cement to 90 percent soils. The soils may contain as much as 20 percent sulfonated hydrocarbon in the upper two feet by weight. The final ratio of materials in the mix for each 100 pounds of slope material may therefore be estimated as follows:

	<b>Sulfonated Hydrocarbons</b>	<b>Water</b>	<b>Sand</b>	<b>Portland Cement</b>
100 pounds of slope material	16.8 lbs	6.4 lbs	76.8 lbs	0 lbs
10% cement	0 lbs	4.0 lbs	0 lbs	6 lbs
Final Percentage	15.3 %	9.5%	69.8%	5.4%

At these percentages, the stabilization mixture is likely to be sloppy due to the high hydrocarbon and moisture content in combination with a soil mixture comprised primarily of sand. Although pozzolanic reactions may improve the strength of the material over time, the sulfate acidity and elevated hydrocarbon content will interfere with the formation of the calcium hydroxides and calcium silicate hydrate crystals required for cementation. Therefore, the mixture of the cement into the soils and hydrocarbon inadvertently becomes bituminous solidification rather than pozzolanic solidification. In bituminous solidification, the cement serves as a filler and density builder with the capability of also neutralizing some acids due to its calcium oxide content.

Although cement may serve as a filler and neutralizing reagent for bituminous solidification, it is not the best-suited reagent for this application. The ideal reagent should have the ability to maximize neutralization of acids while simultaneously reducing moisture content and serving as a density builder. Therefore, this bench scale test will focus on the use of quick lime for bituminous solidification of the soils and hydrocarbon as an alternative to wet cement.

## 2.0 INITIAL MOISTURE ANALYSES

Two one-gallon sample containers arrived on the morning of Saturday, April 19, 2002 from the Purity Oil Site. One sample contained a tarry material with a slightly sulfurous odor and a viscosity similar to that of roofing tar. The other container contained soil from the site that consisted primarily of dry, fine sand. A 50-gram sample from each container was removed and placed into a glass container to determine the percent moisture of the samples. The samples were placed into a convection oven for drying during the weekend at a temperature of 200 ° F. The samples were removed from the oven on Monday morning, April 22 to determine the mass of moisture lost during drying. The results of the testing are summarized in the table below:

	SAND	SLUDGE
Tare Weight	129.31 grams	131.86 grams
Tare + Sample	179.96 grams	182.20 grams
Sample Weight	50.65 grams	50.34 grams
Tare + Dry Weight	177.89 grams	170.69 grams
Dried Sample Weight	48.58 grams	38.83 grams
Weight of Water Removed	2.07 grams	11.51 grams
Percent Moisture	4.1 %	22.9 %

## 3.0 ENERGY BALANCE FOR LATENT HEAT

Moisture analyses were performed on the sludge prior to stabilization testing in order to evaluate the ability of the sludge to absorb heat energy by the latent heat of vaporization. The heat of hydration for calcium oxide as it is converted to calcium hydroxide is equivalent to approximately 500 BTUs of energy per pound of quicklime. One pound of quick lime will consume 0.33 pounds of water during the reaction. Furthermore, the latent heat of volatilization for water in the sludge is approximately 1,180 BTUs. Therefore, one pound of water can consume the heat energy released by hydration of 2.35 pounds of quicklime. Based on these relationships, the maximum amount of quicklime that should be added to a sludge sample during stabilization is equivalent to 1.3 times the mass of moisture in the sample. Since moisture analyses show that the sludge contains 22.9 percent moisture, the quicklime addition rate should not exceed 30 percent.

## 4.0 pH TESTING

Ten grams of tar were weighed into a plastic weigh dish and then broken apart into fine pieces prior to placing the tar into a 250 milliliter glass beaker with 200 milliliters of distilled water for pH testing. A stir bar was placed into the beaker and the beaker was then placed onto a magnetic stirrer. However, the soft tar adhered to the stir bar and stopped the magnetic stir bar from turning. Therefore, a second sample was prepared by placing twenty grams of tar (again broken into fine pieces) into a one-liter glass beaker with 400 milliliters of water. This beaker was placed under a Phipps & Bird PB-700 Jartester for rotational mixing by stainless steel blades immersed half way into the solution. The solution was mixed at an agitation speed of 300 rotations per minute (rpm)

for 20 minutes prior to testing the pH of the solution. The pH was tested with an Oakton Model SR-35624-22 pH meter calibrated with a 4.0 and 7.0 buffer and confirmed against an Oakton 1.68 pH buffer solution. The pH of the sample was measured to be 0.7.

## 5.0 NEUTRALIZATION TESTING

An aqueous pH is not representative of the true equivalent acidity of a sulfonated sludge since not all sulfonated functional groups are deprotosulfonized by hydration. Therefore, a neutralization test was performed on the sludge to determine how much quick lime was required to completely react with the sulfonated hydrocarbons in order to raise the pH above 7.0. Ten grams of quicklime pellets from Genlime of Genoa, Ohio were added to 100 grams of sludge and mixed by hand using a stainless steel spatula. After mixing the sample for approximately five minutes, the sample was allowed to achieve reaction neutralization over a period of one hour. Additional samples were also prepared in a similar manner using 20 percent and 30 percent quicklime addition per weight of sludge.

After all of the samples had reacted for one hour, twenty grams of each sample were placed into a one-liter glass beaker with 400 milliliters of distilled water. The samples were placed onto a Phipps & Bird PB-700 Jartester for mixing at an agitation speed of 300 rpm. After mixing for 20 minutes, each water sample was tested for pH. The pH of the ten percent quicklime sample was 1.7. The twenty percent quicklime sample had a pH of 2.5 and the thirty percent quicklime sample had a pH of 7.8. This test showed that three parts quicklime to ten parts sulfonated hydrocarbon sludge is required to completely neutralize the acidity of the sludge. A portion of the quick lime was likely consumed by other constituents in the sludge unrelated to sulfuric acid acidity.

## 6.0 SOLIDIFICATION TESTING

After treatment with 30 percent quicklime, the sludge retained a tarry consistency due to the low molecular weight of the tar. This type of soft tar can generally only be stabilized by bituminous solidification rather than pozzolanic stabilization. In bituminous solidification, native soils and/or other fill materials are added to the tar as a filler and density builder. Past experience with these types of sludges suggests that four to five parts filler to organic material is typically required for solidification. Therefore, 400 grams of soil were added to 100 grams of neutralized sludge. The components were mixed by hand with a stainless steel spatula for approximately five minutes until a homogeneous mixture was achieved.

After mixing, the material was placed into a metal container and placed sideways onto a heat plate to determine if the material would flow when subjected to heat. A thermometer was placed into the center of the sludge and the heat plate was turned to its highest setting. Due to the low thermoconductivity of the soil/sludge mixture, approximately two hours passed before a temperature reading of 400 ° F was observed on the thermometer. No tar flowed from the mixture during this test, thus indicating that the tar had been immobilized. A sample of the final mixture was set aside for further geophysical testing and/or proctor analyses at a later date if desired.

May 17, 2002

Mr. Mark D. Lewis  
Tetra Tech EM Inc.  
3281 South Maple St.  
Malaga, CA 93725

**RE: Purity Oil Sales Superfund Site**

Dear Mark:

SECOR International Incorporated (SECOR) has prepared and enclosed the Bench Scale Solidification Report for Sulfonated Sludge in Side Slope Soils, Purity Oil Sales Superfund Site, Fresno County, California.

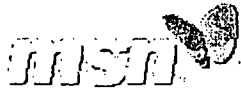
If you have any questions or comments, please do not hesitate to call me at (517) 349-9499 extension 31.

Sincerely,  
**SECOR International Incorporated**

Jeremy M. Rasmussen, P.E.  
Associate Engineer

enc.

cc: Rose Marie Caraway (EPA)  
Jerry Sedgewick (CEMC)  
Scott Jordan (SECOR)

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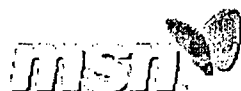
Dear Mark:

SECOR International Incorporated (SECOR) has prepared and enclosed the Bench Scale Solidification Report for Sulfonated Sludge in Side Slope Soils, Purity Oil Sales Superfund Site, Fresno County, California.

Craig Skiera  
Senior Engineer  
SECOR International Inc.  
cskiera@secor.com  
(517) 349-9499 x-22

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RECEIVED  
MAY 30 2002

**SECOR**  
International Incorporated

May 29, 2002

Rose Marie Caraway  
Remedial Project Manager  
Hazardous Waste Management Division SFD 7-2  
U.S. Environmental Protection Agency  
Region IX  
75 Hawthorne Street  
San Francisco, CA 94105

**RE: Geo-technical Evaluation and Conceptual Construction Approach  
Operable Unit Two - Purity Oil Sales Superfund Site, Fresno, CA**

Dear Ms. Caraway:

SECOR International Incorporated (SECOR), on behalf of ChevronTexaco, has prepared a document that addresses EPA's outstanding concerns, and details our conceptual approach for the Purity Oil Sales Site OU-2 construction. This approach addresses moving the closure cover system off of the FID pipeline easement and incorporating approximately 14,000 yards of off-site soil into the footprint. In developing our approach, slope stability and geo-technical evaluations were conducted and these issues are addressed in the enclosed document.

If the EPA generally concurs with this approach, the specific details associated with implementation will be thoroughly described in a forthcoming work plan. So that the remedy construction can move forward in a timely manner, SECOR would appreciate EPA's response to this letter by June 6, 2002. SECOR is currently prepared to begin moving in-place materials off of the FID easement, and EPA's concurrence with this approach will allow this work to begin.

If you have any questions or comments regarding the enclosed document, please contact me by telephone at (517) 202-5617 or via email at [joscojo@aol.com](mailto:joscojo@aol.com).

Sincerely,  
**SECOR International Incorporated**

*Scott Jordan*

Scott Jordan  
Project Coordinator

Enc.

cc: Kathi Moore, Region IX EPA  
Jim Sickles, Mark Lewis, Jerry Fauchaux, TetraTech EMI  
Jerry Sedgwick, ChevronTexaco

May 28, 2002

Mr. Jerry Sedgwick  
Environmental Manager, Superfund Business Unit  
Chevron Environmental Management Company  
6001 Bollinger Canyon Rd., Room K-2094  
San Ramon, California 94583-2324

**RE: Purity Oil Sales Superfund Site, Fresno County, California**

Dear Jerry:

As discussed at our meeting with USEPA on Monday, May 13, 2002, USEPA may require excavation of approximately 14,000 cubic yards of visually-impacted soil outside the perimeter of the Purity Oil Sales Superfund Site (the Site). SECOR completed a conceptual re-design of the closure cover system to incorporate the off-site material. In addition, SECOR conceptually re-designed the closure cover footprint to be completely outside the Fresno Irrigation District (FID) right-of-way.

This letter summarizes the results of this conceptual re-design, as well as addresses two other outstanding issues related to the closure cover system: subgrade compaction and slope stabilization. SECOR has conducted engineering evaluations on each of these issues, and includes summaries of our positions herein.

## **PURPOSE**

The purpose of this letter is to document SECOR's evaluation and findings on each of the following four issues:

- Geotechnical requirements for the closure cover system;
- Potential closure cover system footprint changes to clear the FID easement;
- Subgrade and final closure cover grade changes to incorporate 14,000 yards of off-site soil; and
- Incorporating an additional factor of safety to prevent tar migration through the subgrade slopes into the foundation layer.

Each of these issues is detailed in the following sections.

## **GEOTECHNICAL REQUIREMENTS**

SECOR has reviewed the slope stability analysis previously prepared by Smith Environmental (Smith) in 1996, which was subsequently re-evaluated by the IT Corporation (IT) in 2001. Following our review of the referenced slope stability analyses, SECOR has revised the slope stability model to reflect the most current design conditions. This revised slope stability analysis is described as follows.

### **Slope Geometry**

The geometry of the existing slopes was evaluated based on the proposed final cover design, the recent topographic survey of the Site, and a previous cross section of the Site that was prepared by Smith (1996). The slopes will be graded at an approximate inclination of 3:1 (horizontal to vertical). The maximum height of the waste materials is approximately 12 feet. The waste materials will be overlain by a final cover system. On the top of the landfill, the final cover will consist of a two-foot thick foundation layer (including a geocomposite gas collection layer) overlying the waste materials, followed by the geosynthetic clay liner (GCL), geomembrane, drainage geonet, and a two-foot thick vegetative layer.

On the sideslopes of the landfill, the final cover will consist of a two-foot thick foundation layer (with gas collection layer) overlying the waste materials. The foundation layer will be separated from the waste materials with a geosynthetic, non-woven fabric, as detailed below. Overlying the foundation layer will be a GCL, geomembrane, drainage geonet, and a two-foot thick vegetative layer. As indicated on Smith's cross-section, waste materials were placed below the existing grade in sumps as deep as 12 feet. The slope configurations of the sump excavations were at an inclination of approximately 8:1 (horizontal to vertical). For analysis, a sump excavation was assumed to be located under the toe of the slope.

### **Soil Properties**

The soil properties previously modeled by Smith and IT were reviewed to determine their sufficiency based on the observed current and past conditions, and the proposed design conditions. The Smith and IT soil properties were modified where necessary.

To accurately reflect the proposed final cover design, SECOR's slope stability analysis considered the actual soil properties of the final cover design, as opposed to modeling the cover as boundary load. Conservative soil properties were chosen for the material types to be placed in the final cover.

The soil properties of the waste material were modified to correctly account for shear strength properties based upon SECOR's observation of the waste materials at the Site and Smith's previous laboratory testing. The average cohesion determined from several unconfined compressive strength tests was used in SECOR's analysis, similar to the Smith and IT analysis. However, assigning a friction angle of zero to the waste material is too conservative for this design application. The



average friction angle of the waste soil samples tested by Smith for unconsolidated, undrained triaxial shear strength was equal to 33.9. Smith concluded that a friction angle should not be used for the waste materials to account for the build up of soil water pore pressure in the low-permeability waste materials following final cover placement. It is unlikely that soil water pore pressure will increase following final cover placement. Although the waste materials will not benefit from the effects of evapotranspiration, one purpose of the final cover is to decrease the amount of water infiltration. Therefore, assigning a friction angle to the waste materials appears appropriate. For extremely conservative design purposes, only 15 percent of the average tested friction angle was used in the analysis. A summary of the soil properties used in SECOR's analysis is summarized in the following table.

Material Type	Wet Density (pcf)	Cohesion, C (psf)	Friction Angle, $\phi$ (degrees)
Vegetation Layer	120	0	28
GCL / Soil Interface	85	0	24
Foundation Layer	125	0	30
Waste Material	107	275	15
Native Sand	106	0	40

### Seismic Conditions

The Site, as is all of California, is located in a seismically active area. Ground motions were estimated corresponding to a design bound earthquake (DBE), having a 10 percent probability of exceedance over a 50-year time period. The site-specific peak ground acceleration (PGA) for the DBE was estimated through a probabilistic seismic hazard analysis (PSHA) using the computer program FRISKSP, Version 4.00. The faults used in the PSHA were based upon the current CDMG fault catalog.

The PGA was developed using Boore's 1997 ground motion attenuation relation for soils with a shear wave velocity equal to 310 m/s. Dispersion in Boore's ground motion attenuation relationship was considered by inclusion of the standard deviation of the ground motion data in the attenuation relationship used in the PSHA. The estimated PGA for the DBE is 0.13g.

Slope stability analysis that includes earthquake loading generally is modeled by pseudo-static conditions. Pseudo-static conditions consider earthquake loading, as represented by an equivalent horizontal force. This horizontal force is a percentage of the weight of the failure sliding mass. This percentage is referred to as the seismic coefficient (k).

An appropriate seismic coefficient is typically between 10 and 15 percent for earthquake magnitudes between 6.5 and 8.25 (Seed, 1979). The seismic coefficient is generally selected as some fraction of the PGA to represent the repeatable accelerations that the sliding mass might be subject to, opposed the short term peak acceleration. Research has shown that a seismic coefficient equal to

50 percent of the PGA will generally result in permanent seismic deformations less than two inches (Hynes and Franklin, 1984, and Anderson and Kavazanjian, 1995). Deformations less than four inches are unlikely to correspond to serious landslide movement and damage (CDMG, 1997).

A seismic coefficient equal to seven percent was used for the psuedo-static slope stability analysis. In addition, the maximum seismic coefficient capable of maintaining a safety factor greater than 1.1 was determined.

### Method of Analysis

Stability analysis was made by evaluating both translational (block) and rotational failure conditions. In translational failure, the potential slip surface is composed of planar segments. In rotational failure, numerous circular shaped potential slip surfaces were analyzed by the Bishop Method. The factor of safety against global slope stability failure was evaluated for the "worst case" slip surface (lowest safety factor) through the use of the computer program "GSLOPE," developed by MITRE Software Corporation.

A summary of SECOR's slope stability analysis is summarized in the following table. The minimum acceptable factor of safety is generally 1.1 under psuedo-static loading conditions and 1.5 for static loading conditions.

Failure Surface	Static FS	Pseudo-Static FS (k=0.07)	k <sub>max</sub> (Pseudo-Static FS=1.1)
Circular	1.7	1.4	0.14
Block	1.8	1.5	0.19

Due to the geometry of the 3:1 slopes, the failure surfaces for both rotational and block failure sequences are relatively shallow and do not extend below the toe of slope. This provides stable conditions for the side slopes, even if the toe is located above waste materials.

The calculated factors of safety exceed the minimum acceptable factors of safety. Additionally, the maximum seismic coefficient that will have an acceptable factor of safety under seismic loading is greater than the site-specific PGA. Consequently, the risk of failure is expected to be minimal.

### Subgrade Compaction Considerations

Based on the available compaction data to date, the majority of the compaction tests completed in waste materials were 90 percent of the maximum dry density and within three percent of the optimum moisture content. However, several areas had compaction test results less than 90 percent of the maximum dry density or greater than three percent of the optimum moisture content. In addition, there is some uncertainty regarding the adequacy of the available compaction test data.

The Smith earthwork specifications reviewed do not have compaction or moisture specifications for the waste materials. Accordingly, compaction test results taken in the waste materials may be beneficial for design information purposes, but they are not required as part of the earthwork specifications. It would be expected that at the Site, waste materials would be compacted in a manner similar to a typical landfill operation. Due to the composition of the waste materials at the Site, which includes wood, concrete, rebar, and petroleum hydrocarbons, typical soil compaction density tests in waste materials are not feasible, nor would they be common practice. Waste materials are generally compacted to increase the capacity of the landfill and to reduce post-closure settlements. However, waste materials are not generally compacted to a specified density or moisture content.

For slope stability modeling purposes, SECOR's closure cover design assumes that the waste materials are not dense (wet density = 106 pounds/cubic foot) and have a relatively low shear strength ( $\phi = 5$  and cohesion = 276.5 pounds/square foot). Nominal compactive effort would be required to achieve these modeled parameters in the waste materials. Therefore, it appears that the waste materials have been sufficiently compacted to meet the minimum parameters modeled in the slope stability analysis, based on the review of the compaction tests taken in the waste materials.

The specifications for landfill closure covers in California are stated in CCR Title 23, Section 2581 (a). The state regulations require that a foundation layer be well compacted at optimum moisture content and a minimum of two feet thick. There are no specifications for the waste material subgrade upon which the foundation layer is to be placed.

Although there are no specific requirements for the waste material subgrade in the state regulations, the Smith earthwork specifications have requirements for the subgrade materials. Where excavation is required to achieve the design subgrade elevation, upon reaching the subgrade, the materials shall be scarified a depth of six inches and compacted to a minimum of 90 percent of the maximum dry density (Section 3.3.A.4.). All debris (undefined) shall be buried at least one foot below the design subgrade elevations (Section 3.4.B.2.). Subgrade soils shall not be composed of any material larger than three inches in diameter (Section 3.4.C.1). Subgrade soils shall be compacted at a moisture content within three percent of the optimum moisture content (Section 3.4.C.3.).

At this time it is not known if the existing subgrade has been compacted in strict accordance with the Smith earthwork specifications. Should additional waste material be placed at the site, the existing subgrade would become part of the waste materials and would not be subject to the subgrade specifications. The new subgrade, following additional placement of waste materials, would then be subject to the earthwork specifications.

After reviewing the Smith earthwork specifications, it appears that the specifications for the subgrade are too restrictive regarding the compaction requirement. The subgrade is/will be composed primarily of waste materials, not necessarily a nearly homogeneous soil type. As such, it is difficult to quantify the level of compaction achieved. It is more appropriate to require the subgrade to be graded and compacted such that the contractor is able to achieve the required compaction specifications in the soil foundation layer.

In addition, mitigative measures (i.e. cement soil stabilization) are not necessary to stabilize the landfill slopes. The conservative soil parameters used to model the waste materials, including the subgrade of the side slopes, assume a low density and relatively weak soil type. These soil parameters adequately reflect the possibility of near-surface tarry sludge (discussed in detail in the following sections).

During excavation and construction of the relocated side slopes, additional waste materials will be exposed for visual observation. Where newly exposed subgrade soils visually appear to have insufficient strength, the oversite engineer will conduct pocket penetrometer tests on the newly exposed materials to assess their strength properties. If the shear strength of the exposed materials is determined to be less than the values that were used in the slope stability analysis, the soils will be amended or removed and replaced with competent materials.

## **FID FOOTPRINT MODIFICATIONS**

The USEPA has expressed concerns that any portion of the closure cover system that encroaches on the FID easement will be subject to potential future damage from the FID repairing/replacing their line. In response to this concern, SECOR has evaluated moving the southern closure cover system footprint north off the 40-foot wide FID easement. By moving the closure cover system's south footprint 18 feet north, the cap and perimeter drainage swale can be located completely outside the FID easement, as shown on Figure 1.

However, to achieve this clearance, approximately 6,000 yards of existing subgrade material would have to be excavated and placed further north within the cap footprint. This material has been accounted for in the conceptual grade re-design presented below. Reducing the cap footprint off the FID easement would ultimately raise the final cap elevations by approximately 0.7 feet to incorporate the relocated material. This additional material and cap grade change was taken into account in the geotechnical analysis detailed above, and can be implemented without negatively affecting the closure cover system stability.

## **CONCEPTUAL GRADING PLANS**

SECOR completed a conceptual re-design of the closure cover system subgrade to incorporate the off-site soil. This conceptual grading plan includes a closure cover system footprint that does not encroach on the FID easement, as discussed above. Based on USEPA estimates, SECOR assumed 14,000 cubic yards of off-site soil will be placed within the limits of the closure cover. As shown on the attached Figure 1, the 14,000 yards of material can be incorporated into the closure cover system by raising the subgrades as shown. Figure 1 shows both the conceptual subgrade and final design grades.

Incorporation of the off-site material will result in an approximate height increase of 1.8 feet over the Smith 100% Design height. When added to the 6,000 yards of material necessary to be moved to clear the FID easement (as detailed above), the final cap height would increase by approximately 2.5 feet, although the conceptual re-design was developed with eastern portions of the cap raising

by as much as four feet to accommodate the majority of the additional material (as shown on Figure 1). The conceptual re-design grades can be met while achieving a stable closure cover system, as described in the geotechnical analysis above.

## **ADDITIONAL FACTOR OF SAFETY**

Upon mobilization to the Site, SECOR conducted a comprehensive walk-through and inspection of the Site, including the subgrade side slopes. During this inspection, some tarry sludge was observed on the surface of the side slopes, primarily along the northern slopes. The sludge observed in the slopes consists primarily of sulfonated hydrocarbon sludge, which is created by a process that reacts sulfuric acid with hydrocarbons for purification. The sludge at the Site is the waste product from this process. The sulfonated hydrocarbons in the sludge are generally stable at room temperature. However, if heated, the sludge can experience a protodesulfonation reaction, which releases the sulfur trioxide group from the hydrocarbon. Although temperatures of 100 degrees Fahrenheit (°F) are generally required to initiate this reaction, protodesulfonation reactions have been observed from solar heating at temperatures ranging from 70°F to 80°F when the sludge is less than three feet below ground surface.

When solar heating initiates the protodesulfonation reaction, the sludge can expand and create a "tar boil" at the surface. Once the sludge is exposed at the surface, solar energy can increase the temperature of the sludge to well above 100°F due to solar radiation. At these elevated temperatures, the sludge will desulfonate, expand, and flow more readily, since the viscosity is reduced at high temperatures. The appearance of the sludge is due to reactions that occur from direct solar exposure of sludge at the surface, not reactions in the subsurface. Therefore, the aggressive expansion of the sludge only occurs when heated by direct radiant exposure.

The simplest methods to prevent the tar boils from occurring is to neutralize, remove, or cover the sulfonated sludge so that no untreated sludge exists in the upper three feet of soil where it can be affected by solar heating. Neutralization and stabilization of the sludge in the side slopes was proposed by IT Corporation through the use of Portland cement. SECOR recently proposed the use of quicklime as a more suitable reagent for stabilization and neutralization. However, EPA raised concerns of fugitive emissions associated with mixing of the materials.

A more suitable method of addressing the sludge would involve covering the material with at least three feet of soil to eliminate solar heating of the sludge. The remedial design calls for placement of four feet of soil over the side slopes. This volume of soil is adequate to insulate the effects of solar heating. However, geotechnical mitigation measures for the side slopes may be required to compensate for soft spots in the side slope created by sludge located immediately below ground surface.

To provide this additional level of safety, SECOR will place geotextile fabric on the subgrade slopes prior to construction of the foundation layer. The fabric will cover the slope from top to toe around the entire closure cover system footprint perimeter. The geotextile fabric will provide additional strength to the near-surface tarry sludge deposits in the side slopes, thereby mitigating localized

Mr. Jerry Sedgwick  
May 28, 2002  
Page 8 of 9

settlement of the foundation layer, and eliminating the need for chemical stabilization, since slope stability will not be an issue (as described above).

If you have any questions or comments regarding this letter, please contact me at (517) 202-5617.

Sincerely,  
**SECOR International Incorporated**

*Scott Jordan*

Scott Jordan  
Construction Quality Assurance Specialist  
Project Coordinator

cc: Jeremy Rasmussen .  
Jim Burns  
Todd Shibata  
Dan Oberle  
Gary Cameron

Mr. Jerry Sedgwick  
May 28, 2002  
Page 9 of 9

**References:**

Anderson, D.G. and Kavazanjian, E., April 7, 1995, Performance of Landfills under Seismic Loading," Invited State-of-the-Art Paper for the Third International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, University of Missouri, Rolla.

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Hynes, M.E. and Franklin, A.G., 1984, "Rationalizing the Seismic Coefficient Method," Miscellaneous Paper GL-84-13, US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

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Seed, H.B., 1979, Considerations in the Earthquake-Resistant Design of Earth and Rockfill Dams, Geotechnique, Volume 29, Number 3.

Smith Environmental (Smith), May 31, 1996, Final (100%) Design Report, Operable Unit Two (OU-2), Purity Oil Sales Site, Fresno, California.

**ATTACHMENT**  
**SLOPE STABILITY ANALYSIS**

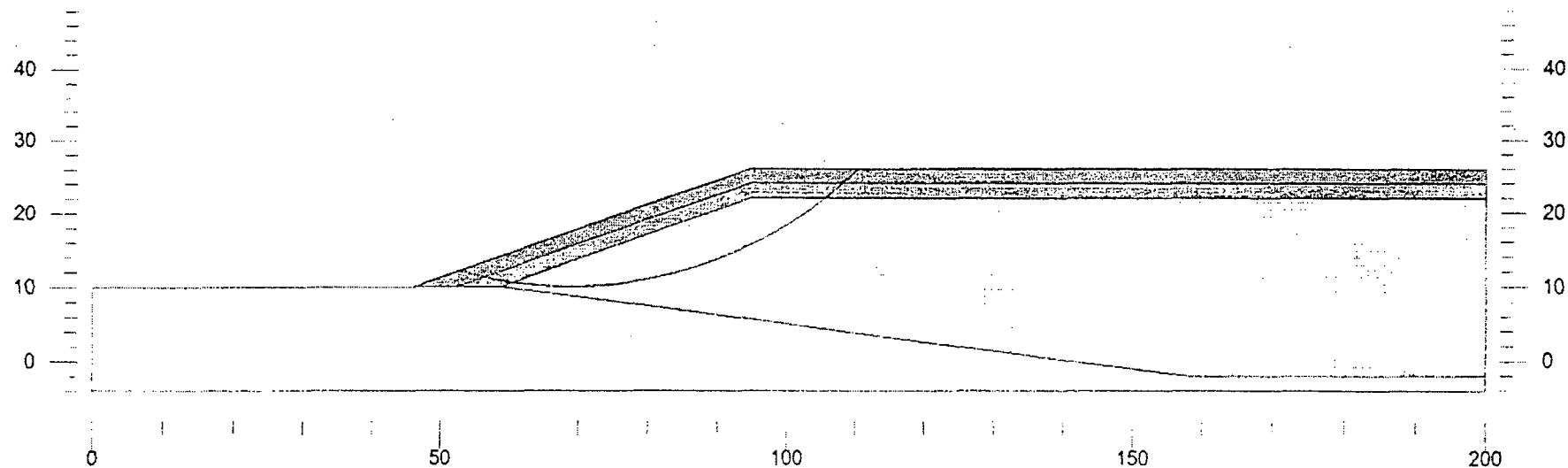


	Gamma pcf	C psf	Phi deg	Piezo Surf.	Ru
Vegetation Layer	120	0	28	0	0
GCL Interface	85	0	24	0	0
Foundation Layer	125	0	30	0	0
Waste Material	107	275	5	0	0
Native Sand	106	0	40	0	0

Seismic coefficient = 0.14

Secor International Inc. - Redlands, CA  
 24CH.67001.00  
 Purity Oil Superfund  
 May 22, 2002  
 3:1 slope  
 Max waste slope height 12 feet

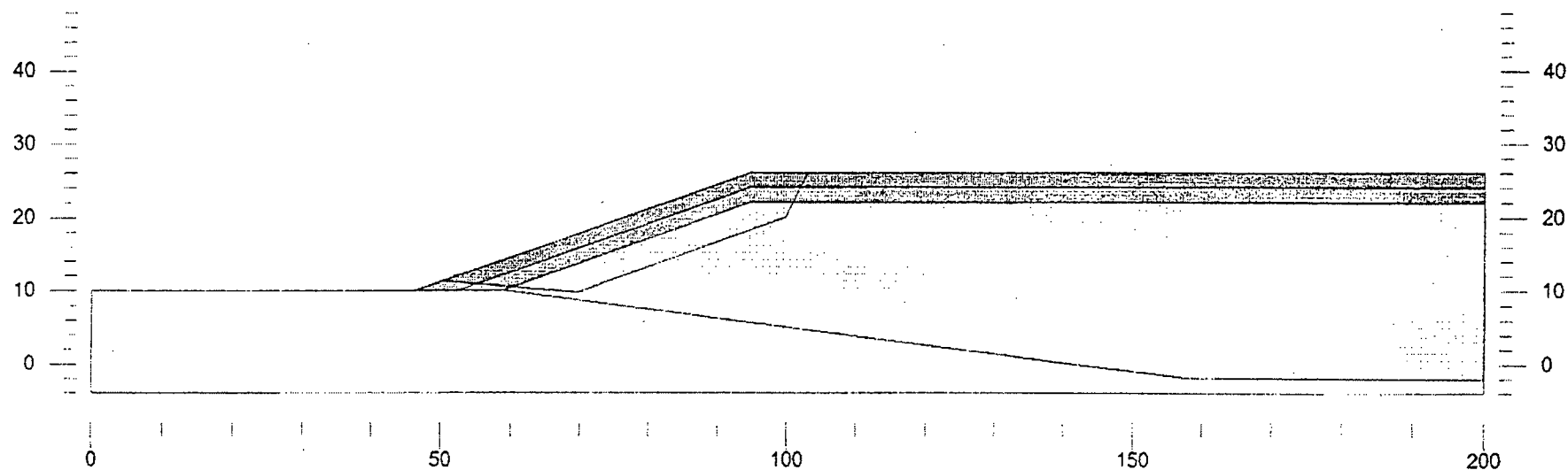
✕  
 F = 1.118



	Gamma pcf	C psf	Phi deg	Piezo Surf.	Ru
Vegetation Layer	120	0	28	0	0
GCL Interface	85	0	24	0	0
Foundation Layer	125	0	30	0	0
Waste Material	107	275	5	0	0
Native Sand	106	0	40	0	0

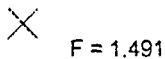
Secor International Inc. - Redlands, CA  
 24CH.67001.00  
 Purity Oil Superfund  
 May 22, 2002  
 3:1 slope  
 Max waste slope height 12 feet

×  
 F = 1.847



Vegetation Layer  
GCL Interface  
Foundation Layer  
Waste Material  
Native Sand

Secor International Inc. - Redlands, CA  
24CH.67001.00  
Purity Oil Superfund  
May 22, 2002  
3:1 slope  
Max waste slope height 12 feet

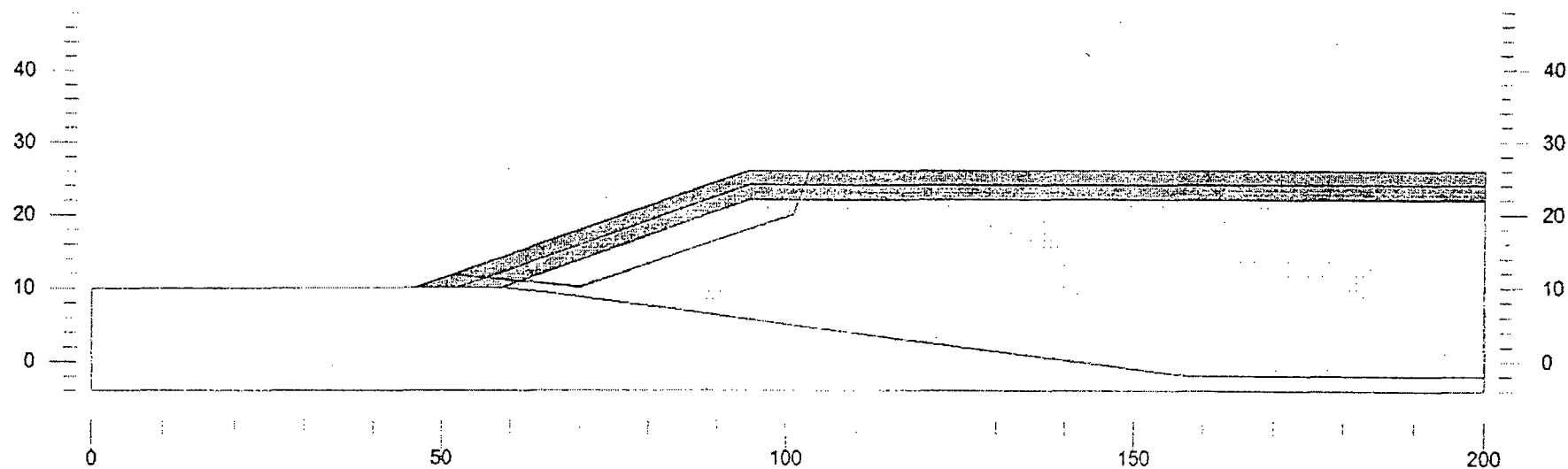


	Gamma pcf	C psf	Phi deg	Plezo Surf.	Ru
Vegetation Layer	120	0	28	0	0
GCL Interface	85	0	24	0	0
Foundation Layer	125	0	30	0	0
Waste Material	107	275	5	0	0
Native Sand	106	0	40	0	0

Seismic coefficient = 0.19

Secor International Inc. - Redlands, CA  
 24CH.67001.00  
 Purity Oil Superfund  
 May 22, 2002  
 3:1 slope  
 Max waste slope height 12 feet

✕ F = 1.127



**To:** Rose Marie Caraway, EPA  
Rick Sugarek, EPA

**From:** Jim Sickles, Tetra Tech EM, Inc.

**Cc:** Kathi Moore, EPA  
Mark Lewis and Jerry Faucheux, Tetra Tech EM, Inc.

**Date:** October 3, 2001

**Subject:** Constructability Issues for (1) Anchor Trench in Golden State Market Area; (2) Cap extension in Golden State Market Excavation area; (3) North and West Side Slopes of Cap - Purity Oil Superfund Site

As a result of the recent excavation of the anchor trench for the cap in the common area between Purity Oil Superfund Site, Tall Trees Trailer Park, and the excavation behind the Golden State Market several issues concerning the constructability of the cap as currently designed and the effectiveness of the remedy. The purpose of the closure cover, as stated in the ROD, are (1) to prevent direct human contact with waste materials, and (2) minimize leaching of waste contaminants to groundwater, and (3) meet the regulatory requirements for construction of a closure cover system. The excavation of the anchor trench along Tall Trees Trailer Park and behind the Golden State Market on September 20 and 21, 2001, along with the excavation on the north side of the cap adjacent to Bruno's Scrap Yard on October 2, 2001 both indicate potential issues in meeting these ROD remedial action objectives. Each of the three areas and the associated concerns is discussed below.

#### **Anchor Trench in the Golden State Market Area**

The situation encountered in the excavation of the anchor trench on September 20 and 21, 2001 is illustrated on Sheet 1 of 2. As shown by the diagram the trench excavation encountered waste pit debris and tarry acidic sludge from 3.5 to 7 feet on both sides of the trench with the floor of the trench encountering the Purity Oil C/D contaminant zone of gray greenish silts and sands. The exploratory anchor trench excavation encountered approximately 240 linear feet with the C/D contaminant zone and approximately 60 linear feet with in place waste pit material on both sidewalls. The current plan by IT and Chevron is to construct the anchor trench with the HDPE liner to a depth of 2 feet as originally designed after backfilling the exploratory anchor trench excavation.

The concerns that this approach raises are as follows;

- Potential horizontal migration of the liquid waste and gases from beneath the cap due to increased load resulting from the construction of the cap
- Potential settling of the soil due to the migration of the liquid phases in the waste pit material which could affect the integrity of the cap
- Potential leaching of the C/D zones between the anchor trench and the Purity Oil property line beneath the backfilled area of the exploratory anchor trench excavation
- Impacting the consideration and elimination of off site contamination remedial actions due to potential damage of the already constructed cap such as failure of the toe or side slopes of the cap
- Human health risk consideration created by leaving waste off site with a liquid and gaseous component along with the potential for leaching of the C/D contaminant zone outside of the cap

#### **Cap extension in Golden State Market Excavation area**

When inspecting the area of the anchor trench excavation on September 28, 2001 some of the same concerns as discussed above became apparent in the area of the excavation behind the Golden State Market. The diagram on Sheet 2 of 2 depicts the situation that occurs in that area. In the excavation of the area behind the Golden State Market in place waste pit material was encountered along the south sidewall and on the southern third of both the east and west sidewalls indicating that the southern third of the excavation was located over one of the Purity Oil waste pits. The specific concerns are created by the lack of clarity in the design documents and subsequent revisions as the location of the edge of the cap in this area. No details have been provided and the latest version of the subgrade drawing 7A implies that the edge of the cap and the anchor trench are located on the southern edge of the excavation area behind the Golden State Market which would create the same issues as noted above. If the actual design intent is to locate the anchor trench on the northern boundary of the Golden State Market excavation area then these issues will not exist.

#### **North and West Side Slopes of Cap**

When excavating the north side of the cap in the area of Bruno's Scrap Metal a large area approximately 50 feet by 30 feet was encountered with abundant tarry sludge and wood and concrete debris. Currently IT is discussing excavating out the material and replacing it with some sort of imported material. The integrity of the cap and side slopes will need to be addressed depending on how extensive the area of in place waste pit material is.

Several results may take place depending on the extent of the waste pit material. Scenarios could be as follows:

- The replacement of the material is successful and no failure occurs

- The slope fails during construction and a redesign with some sort of retaining system is required
- Slope failure does not occur but seepage takes place due to failure of the liner due to liquid and gas migration with time

All of these issues dictate the need for strong monitoring approach as part of the O&M of the site of look for any seepage of gas or liquids, change in the cap configuration such as slip, settling or upheaval. All of these would require metrics to evaluate the performance of the cap along with a agreed approach or process on how to address potential problems in the future.

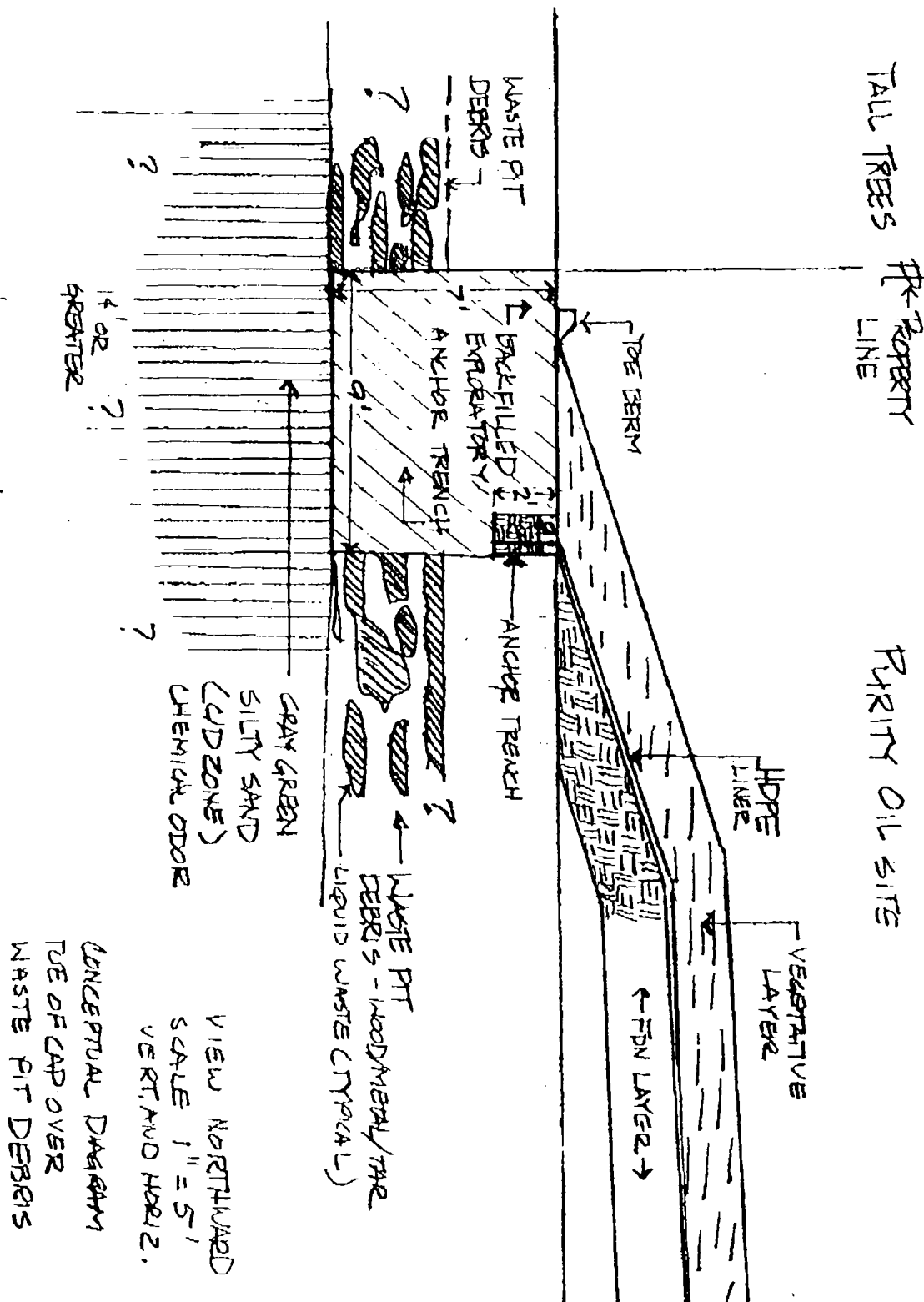


**Tetra Tech EM Inc.**

**CALCULATION / WORK SHEET**

SHEET 1 OF 1

PROJECT PURITY OIL SUPERFUND SITE PRESNO, CA		COMPONENT/SYSTEM	
PREPARED BY J. W. SICKLES	DATE	CHECKED BY	DATE 10/01/01





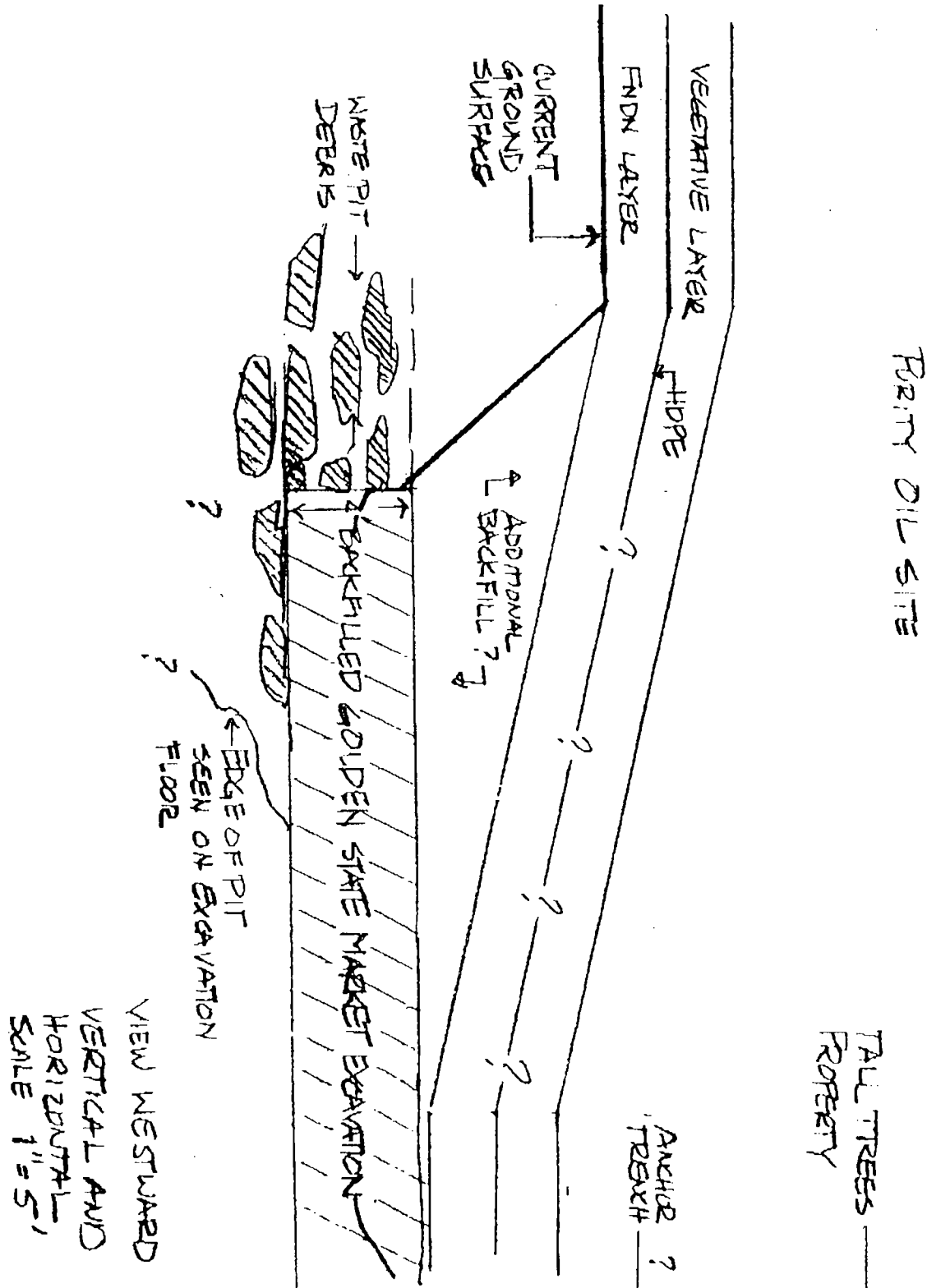


Tetra Tech EM Inc.

CALCULATION / WORK SHEET

SHEET 2 OF 2

PROJECT PURITY OIL SUPERFUND SITE FRESNO, CA		COMPONENT/SYSTEM	
PREPARED BY JIM SICKLES	DATE 10/02/01	CHECKED BY	DATE



**To:** Jim Sickles, Tetra Tech EM Inc.  
Kevin Bricknell, Tetra Tech EM Inc.

**From:** Mark Lewis, Tetra Tech EM Inc.  
Jerry Fauchaux, Tetra Tech EM Inc.

**Cc:** Rose Marie Caraway, EPA  
Rick Sugarek, EPA  
Kathi Moore, EPA

**Date:** October 7, 2001

**Subject:** Constructability/Stability Issues for the North slope-Purity Oil Sales Superfund Site

As a result of excavation on the North Slope, to achieve the elevations and grades depicted on Drawing 7A included as part of Request For Information (RFI) 26, several tar seeps have appeared at the toe of the North Slope (see attached photographs and site map). As part of Tetra Tech EM Inc. (Tetra Tech) letter to SECOR International Incorporated (SECOR) on September 26, 2001, "Review of Request For Information Numbers 24, 25 (Revision No. 2) and 26", Tetra Tech stated that, "If anomalous low strength materials are discovered during construction, the stability analysis should be reevaluated". Do these tar seeps satisfy the previous statement?

During the EPA's and Tetra Tech's review of RFI #26, Tetra Tech requested clarification from IT Corporations (IT) project engineer, Ken Obenauf, regarding test data utilized to analyze the slope stability. IT's project engineer, Ken Obenauf, stated that the same test data that was utilized in the original design (Smith 1996) was once again utilized for RFI #26 slope stability calculations, but if conditions encountered in the field differed, IT would need to re-evaluate the calculations. Is the appearance of the tar seeps at the toe of the North Slope considered a differing condition?

As part of RFI #26, IT utilized unit weights for the cover system, waste layer, and subsurface layers at, 115 pcf, 107 pcf, and 106 pcf respectively. But, when IT conducted a "Bench Neutralization Test of Tar Seep Material from the Purity Oil Site" in May 2001, IT's Technology Development Laboratory reported that the tar had a "bulk density of 71.8 lb/ft<sup>3</sup>". Due to the vast differences in unit weights for the tar material, and the appearance of the tar at the toe of the North Slope, should the slope stability be re-evaluated?

**DRAFT**  
**TAR SEEPS OBSERVED DURING**  
**AMBIENT TEMPERATURES LESS THAN 70° F**  
**PURITY OIL SALES SUPERFUND SITE**  
**FRESNO, CALIFORNIA**

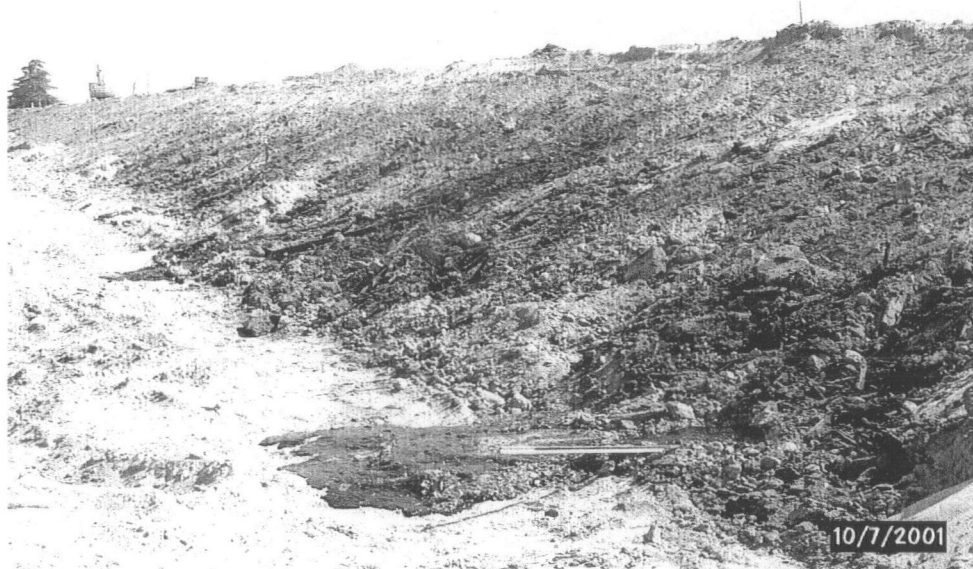
Photograph Numbers	Description/Note(s)	Date Picture Taken	Mean Temp. (°F)	4 Days Prior to Photograph Date			
				Date, Mean Temp. (°F)			
1036-1039	Tar Seeps Along N. Toe	#####	47.4	11/16, 45.7	11/17, 42.9	11/18, 45.0	11/19, 44.3
1068-1069	Fluids Seeping From N. Slope	12/5/2000	48.7	12/01, 47.0	12/02, 46.2	12/03, 44.3	12/04, 45.8
1073-1076	Fluids Seeping From N. Slope and N. Toe, pH < 1	12/6/2000	47.9	12/02, 46.2	12/03, 44.3	12/04, 45.8	12/05, 48.7
1402-1404	Tar Seeps Along N. Slope	10/7/2001	68.4	10/03, 79.8	10/04, 74.7	10/05, 67.8	10/06, 66.5
1279-1280	Tar Seeps Along N. Slope	4/18/2001	NA	NA	NA	NA	NA
1296-1301	Tar Seeps Through Protective Cover Along N. Slope	5/8/2001	NA	NA	NA	NA	NA
1528-1533	Tar Seeps Along N. Slope at Grids S and W, and Rupture on the N. Slope	4/25/2002	NA	NA	NA	NA	NA

**Notes:**

- (1) Mean Temperatures Provided by IT Corp.
- (2) SECOR Provided Mean Temp. Data for May 9, 2002 Which was Approximately 75°. Therefore, the Mean Temp. Data Provided above for May 2001 Should be Comparable. In Addition, the Data Provided above for April 2001 and April 2002 Should be Approximately 70°.
- (3) pH < 1 has been Observed from the North Slope. Refer to Info. Provided Above for 12/06/00.
- (4) NA = Not Available. Met Data not provided by ChevronTexaco's Subcontractor.



Purity Oil Sales Superfund Site - G00DA-193008 Photo # 1402  
Tar seep at toe of North slope(looking west)



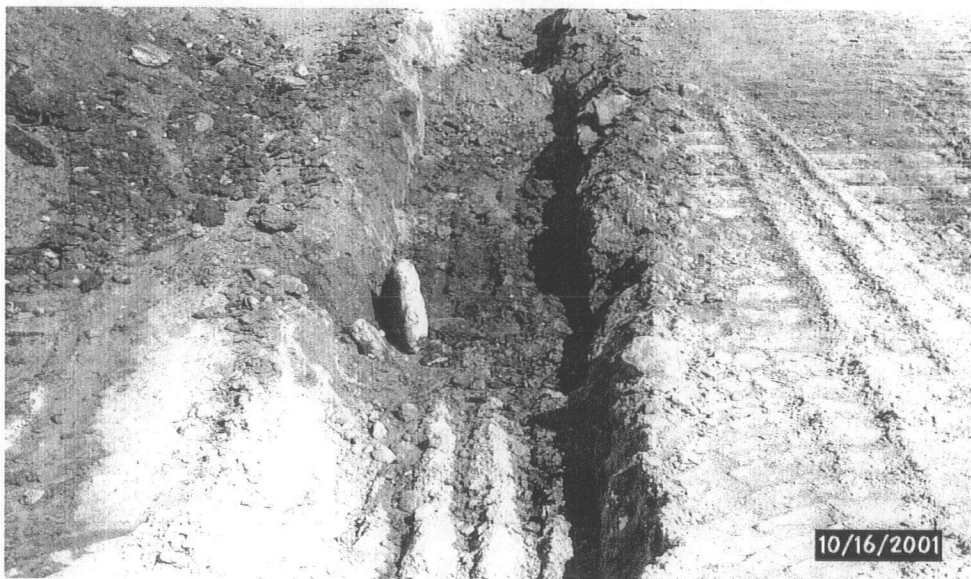
Purity Oil Sales Superfund Site - G00DA-193008 Photo # 1403  
Tar seep at toe of North slope (looking east)



Purity Oil Sales Superfund Site - G00DA-193008 Photo # 1404  
Tar seep at toe of North slope (looking east)



Purity Oil Sales Superfund Site - G00DA-193008 Photo #1416  
Test Pit Excavated on South Slope - Station P - Approx. 1.5 -2.0 ft. deep  
Note: Tarry Waste and Debris encountered throughout excavation (see attached site map and cross-section)



Purity Oil Sales Superfund Site - G00DA-193008 Photo #1417  
Test Pit Excavated on South Slope - Station R - Approx. 1.5 -2.0 ft. deep  
Note: Tarry Waste and Debris encountered throughout excavation (see attached site map and cross-section)

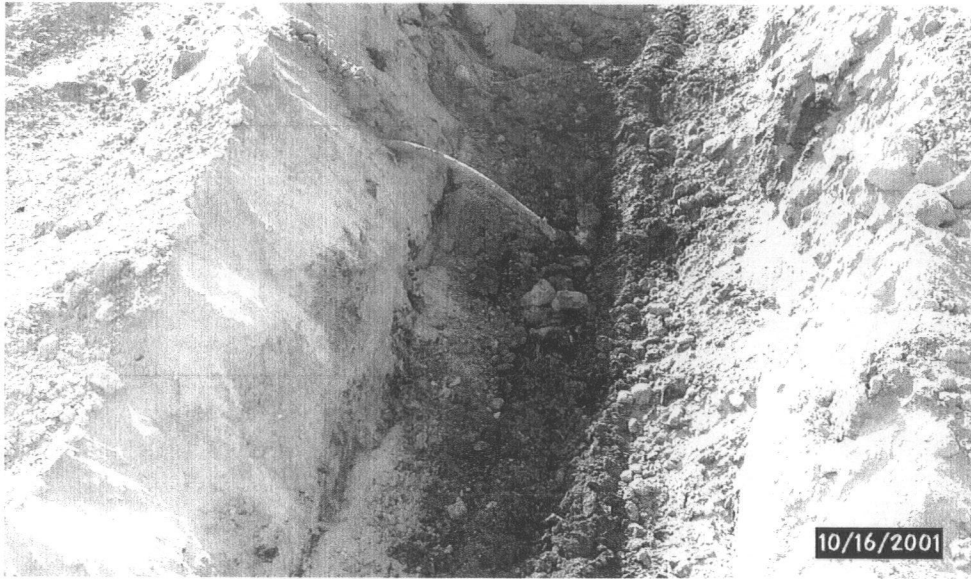


Purity Oil Sales Superfund Site - G00DA-193008 Photo #1418  
 Test Pit Excavated on North Slope - Station V - Approx. 1.5 -2.0 ft. deep  
 Note: Tarry Waste and Debris encountered throughout excavation (see attached site map and cross-section)



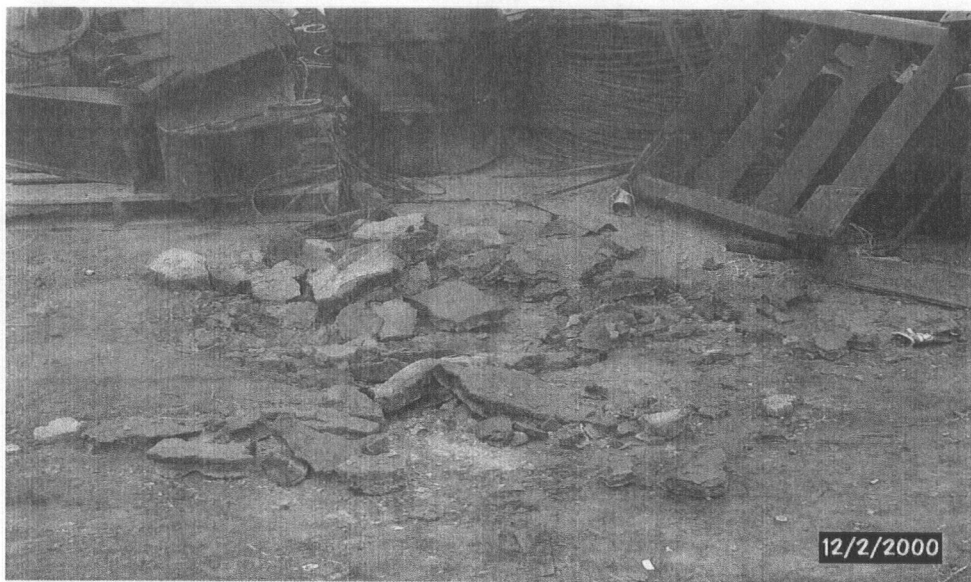
Purity Oil Sales Superfund Site - G00DA-193008 Photo #1419  
 Test Pit Excavated on North Slope - Station L - Approx. 2.0 ft. deep  
 Note: Tarry Waste and Debris encountered throughout excavation (see attached site map and cross-section)



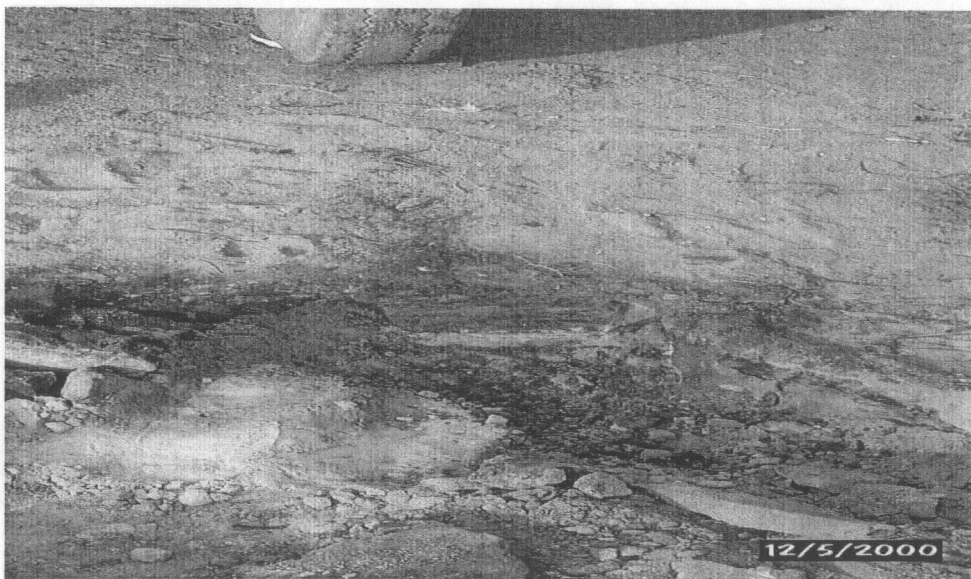


Purity Oil Sales Superfund Site - G00DA-193008 Photo #1420  
Test Pit Excavated on North Slope - Station F - Approx. 1.5 -2.0 ft. deep  
Note: Tarry Waste (liquid seep) and Debris encountered throughout excavation  
(see attached site map and cross-section)

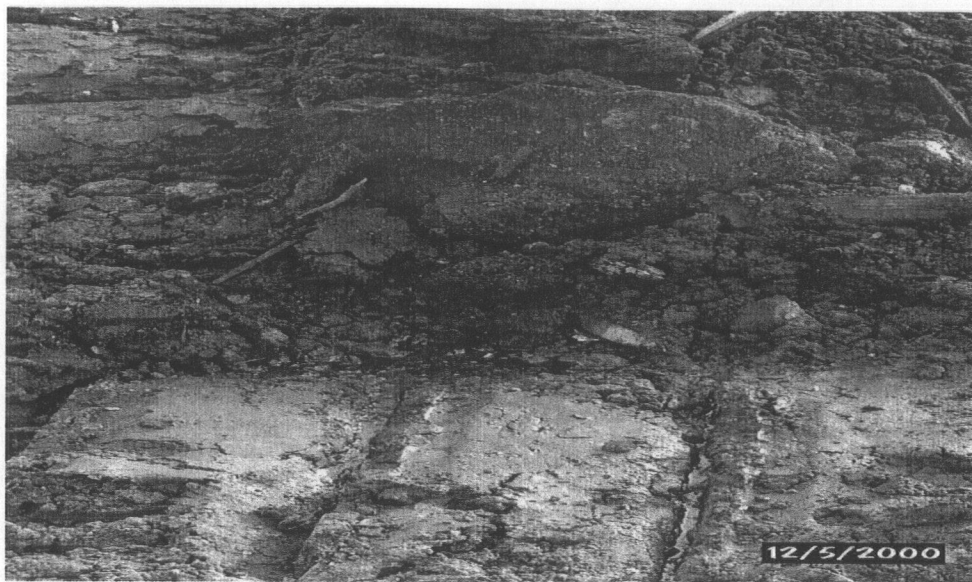




Purity Oil Sales Superfund Site. G00DA-003008 Photo # 1066  
Discolored soils on the south side of Bruno scrape yard property.



Purity Oil Sales Superfund Site. G00DA-003008 Photo # 1067  
Discolored soils south side of Bruno scrape yard.



Purity Oil Sales Superfund Site. G00DA-003008 Photo # 1068  
Seeping fluid from the north slope excavation.



Purity Oil Sales Superfund Site. G00DA-003008 Photo # 1069  
Black discolored soils at toe of the north slope; note seeping fluids.



Purity Oil Sales Superfund Site. G00DA-003008 Photo # 1070  
Sample location south side of the Bruno scrape yard. Sample ID # Bruno  
# 2.



Purity Oil Sales Superfund Site. G00DA-003008 Photo # 1071  
Location of sample ID Bruno # 2.

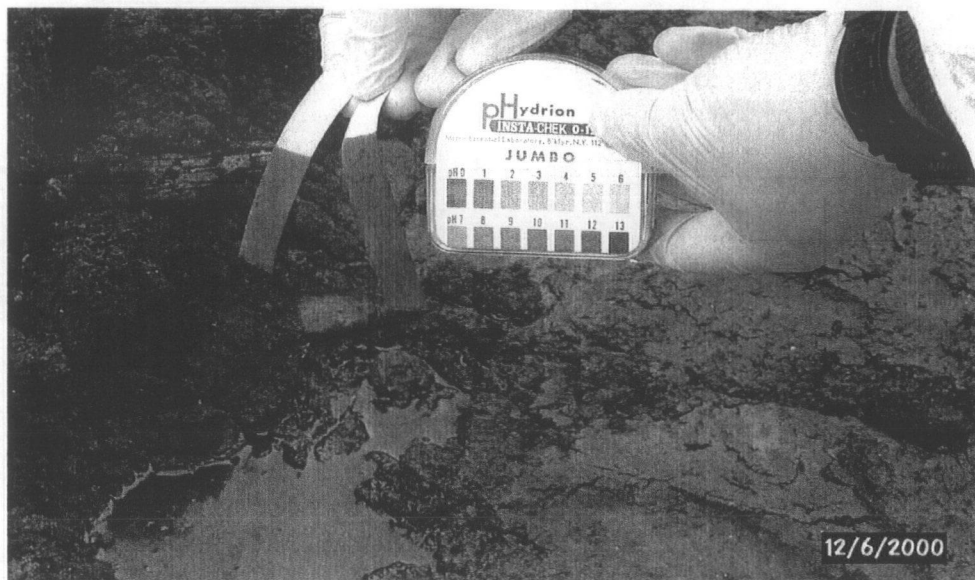




Purity Oil Sales Superfund Site. G00DA-003008 Photo # 1072  
Location of Bruno # 2 sample.



Purity Oil Sales Superfund Site. G00DA-003008 Photo # 1073  
PH test of weeping fluids from toe of the north slope; note color chart  
indicate less than 0.



Purity Oil Sales Superfund Site. G00DA-003008 Photo # 1074  
PH test below 0 on fluids seeping from toe of the north slope.



Purity Oil Sales Superfund Site. G00DA-003008 Photo # 1075  
Fluids weeping from the north slope with PH less than 0.



Purity Oil Sales Superfund Site. GOODA-003008 Photo # 1076  
Fluid seeping from the north slope.



G00DA-193008 Photograph # 1527; North Slope Tar Seep Located in Grid N. Grid N was treated with Quicklime, approximately 2 feet below ground surface, by IT Corporation on October 28, 2001 (NOTE: Tar seeping from quicklime treated slope soils).



G00DA-193008 Photograph # 1528; North Slope Tar Seep located in Grid S.

(NOTE: Tar seeping from erosion channel in subgrade).





G00DA-

193008, Photograph # 1529; North Tar Seep located in Grid S.

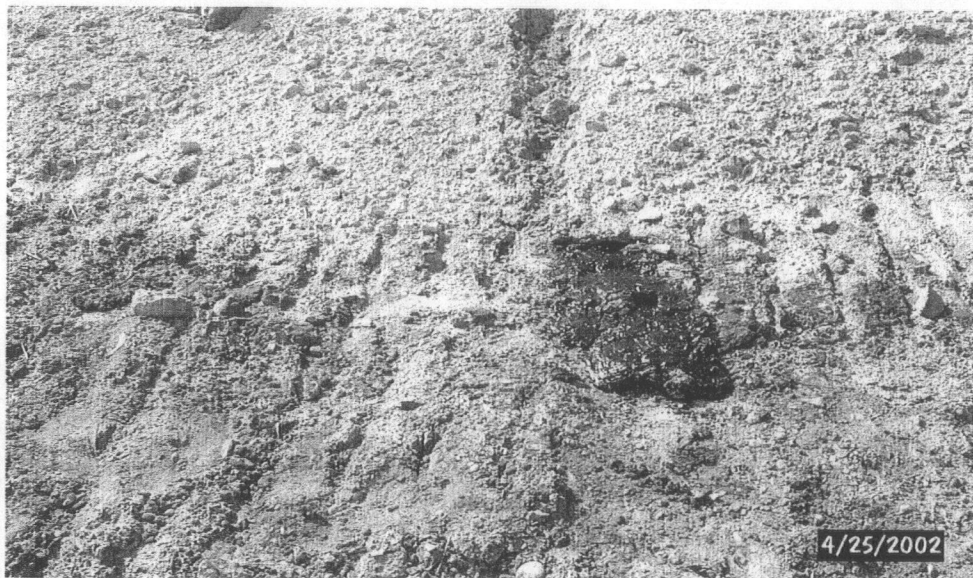
(NOTE: Internal pressure within the subgrade layer appears to have forced the tar to rupture the north slope)



G00DA-193008, Photograph # 1530; North Tar Seep located in Grid S(Looking East).  
(NOTE: Internal pressure within the subgrade layer appears to have forced the tar to rupture the north slope)



G00DA-193008 Photograph 1531; North Slope Tar Seep located in Grid S.  
(NOTE: Tar seeping from erosion channel in subgrade, see Photograph 1532)



G00DA-193008 Photograph 1532; North Slope Tar Seep located in Grid S.  
(NOTE: Tar seeping from erosion channel in subgrade)



G00DA-193008 Photograph 1533; North Slope Tar Seeps (3) located in Grid W.

**To:** Jim Sickles  
**From:** Mark Lewis  
**Date:** November 1, 2001  
**Subject:** Cleared Future Well Locations-Purity Oil Superfund Site

Attached are cross-sections and photographs of the subsurface conditions observed while excavating the future well locations. The future well locations cleared and represented by the cross-sections and photographs are as follows: (1) MW-6-O-S&D, (2) MW-8-O-S, (3) MW-14-O-S&D, (4) CIX-2, (5) CIX-6, (6) CIX-7, and (7) AE-4.

As indicated by the cross-sections, the top 4 feet in all of the cleared locations were fairly uniform with a mixture of sand (0-2 feet bgs), brick, concrete, metal, wood, and soil (2-4 feet bgs). Below 4 feet is where each location varied in the matrix of materials and are as follows:

- ☐ MW-6-O-S&D - black soil mixed with abundant tar pockets from 4-15 feet bgs. At the bottom of the excavation (14 - 15 feet bgs) the greenish/gray soil was encountered
- ☐ MW-8-O-S - black soil/tar mixture from 4-7 feet bgs, and from 7-12 feet bgs(bottom of excavation) a greenish/black soil was encountered
- ☐ MW-14-O-S&D - black soil/tar mixture from 4-7 feet below ground surface (bgs), a black soil with liquid tar pockets was observed from 7-9 feet bgs, and from 9-15 feet bgs (bottom of excavation) a greenish/black soil was encountered.
- ☐ CIX-2 - black soil was encountered from 1.5 - 4 feet bgs, and black/greenish soil, with a strong odor, was encountered from 4 - 14.5 feet bgs (bottom of excavation)
- ☐ CIX-6 - brown sandy silt with gravel (little to no black staining)was encountered from 4 -14 feet bgs (bottom of excavation)
- ☐ CIX-7 - consistent with the other cleared locations in the first 4 feet of excavated material (sand and soil with concrete, metal, and wood), but at 4 feet bgs is where CIX-7 differed from all of the other locations. At approximately 4 feet bgs a brown bubbling liquid (the consistency of water) was encountered. Below this brown liquid (approximately 5 feet bgs) large amounts of tar/sludge and large pieces of concrete were encountered. Several large pieces of concrete were removed from the excavation. These large pieces of concrete were about 2'x2'(square) by about 4 -5 feet in length. The large pieces of concrete are shown in the attached photographs.
- ☐ AE-4 - black soil was encountered at 2 - 4 feet bgs, and from 4 - 13 feet bgs (bottom of excavation) a greenish/black soil (slight odor) was encountered.

## Status of Purity Oil Project:

The current activities on Purity Oil consist of (1) following up on the May 24<sup>th</sup> meeting that we had with EPA and IT; (2) starting work on the residents of the trailer park relocation Feasibility Study (FS); (3) the preparation of a Field Sampling Analysis Plan/ Quality Assurance Project Plan (FSAP/QAPP) for the air sampling in the trailer park; and (3) preparing for the next meeting with EPA and IT on July 26<sup>th</sup>. In addition to those tasks we have to finish the written comments on the Remedial Action Work Plan (RAWP) as well.

### May 24, 2000 – Meeting with EPA and IT Group

The meeting started out with IT passing out a proposed modification to the agenda that Spencer had put together a few days before the meeting and Rose Marie had forwarded to IT. IT added an item at the end that proposed going through the list of comments that they had received as a follow-up to the meeting on 12/10/98 for clarifications of issues. The IT staff presented the implementation of the work in more detail at this meeting than was presented at the last meeting on May 10<sup>th</sup>. The implementation would consist of 12 stages covering a total of 52 construction days with work planned for 5 days a week, 9 hours a day. They will present the details discussed and associated drawings a submittal with a schedule still to be determined. The stages are as follows:

Stage 1 – excavate 6" of the soil on the north side of the old irrigation canal and place it on the south side of the site as base for a haul road. They would also break up the large pieces of rubble on top of the site and spread it out over the site. They would then place 2' of clean fill over this dirty base in 6" lifts – 90% compaction

Stage 2 – dig 1' to 3' in the southeast corner of the site and place it in the center of the site expecting this to add a 12" layer of dirty soil below the foundation base

Stage 3 – place 2' of clean fill (foundation layer) over the eastern(?) half of the site about gravel size for a total of 20,000 yd<sup>3</sup> with 11,000 yd<sup>3</sup> in this placement ( in 3 days)

Stage 4 – excavate the area behind the shotcrete along the fence on the north and west and 4' deep behind the market and place on the west half of the site – criteria for cleanup is visible contamination – all elevations are in reference to MSL and cleaning to level of the trailer park and scrap metal yard current elevations (note if in placing the soil they see pumping they will place over the soft spot a geotextile)

Stage 5 – place 2' of clean fill behind the market

Stage 6 – finish foundation layer

Stage 7 – put in passive gas system by trenching 1 1/2 to 2' into the foundation layer pipe runs to be roughly parallel to surface

Stage 8 – place geosynthetic clay liner/ HPDE/ net and clay

Stage 9 – lay in SVE piping on top of liner, install new air extraction wells with 12" steel casing through waste layer then put in 4 " PVC in that

Stage 10 – place the 2' vegetative layer – 85% proctor, with first 12" to be 90% compacted - total of 19,500 yd<sup>3</sup>

Stage 11- shotcrete and concrete work on slopes and install fencing

Stage 12 – hydroseed

Assumptions for schedules are:

500 yd<sup>3</sup>/day compact and excavate using 2 excavators, dozer and compactor

4000 yd<sup>3</sup> /day to import fill

80 yd<sup>2</sup> of shotcrete/day

Questions that arose were:

The nature of the edge along the rear market area

Did we agree that they did not need to scarify the soil at 6" for the foundation base layer

If it would be easier when breaking the surface rubble to 3" to simply dispose of off site

How many tests at the clean fill source were needed

How many tests per ft<sup>2</sup> and per lift were adequate

How many proctor tests would be representative

Was chemical testing of backfill necessary to address acidity of waste below

Was the number of truck loads a day realistic on this small a site

Was the total construction time of 52 days ( 10 weeks ) realistic

Does the remedy meet future use , auto parts already wants site to park cars

TtEMI then expressed concern over

the seeps on the surface and potential for more movement

settlement of the cap and sides will it hold in the sludge

how to handle oils when uncovered

concern over mass transfer due to long term diffusion of VOCs in soil

which monitoring wells should be abandoned

how to decide if we need to start the SVE

confirmation samples where we dig up and haul on site to know what was left in place

The group then went through the comments from the 12/10/98 set of RTCs and It was to write up minutes and submit a package

#### Trailer Park Residents Relocation FS

Even though EPA has been approached by Chevron that they would be willing to temporarily relocate all of the residents of the trailer park for the 10 weeks of construction EPA still wants to move ahead with the FS. They have looked at the approach that we have proposed and approved it. The next step will be to meet this week sometime and lay out the roles and responsibilities of each of use and get a budget and schedule in place.

#### Air Sampling FSAP/QAPP for the Trailer Park study

EPA wants to start this as soon as possible but the soonest that we could get into the field for this work is mid September to October. Eric Farsted and Jon Bridges in Denver will be helping us with this effort and are starting to scope the work and prepare a FSAP/QAPP for EPA's review.

#### Prepare for the next IT meeting on July 26,2000

At the next meeting the subjects beyond the follow-up to the last meeting will be to discuss the groundwater monitoring plan and specifically the proposed wells to be abandoned. Victor Early will be helping us with some of groundwater issues that could arise from the monitoring plan. Currently IT is working on the 5 year review document so this would be a good time to mention

any of our concerns. We will need to evaluate the proposed wells to be abandoned, how the future monitoring will tell us if the cap is working and how to integrate the approach with the need to use the SVE system that is being installed on a contingent basis.

# Memorandum

**To:** Jim Sickles  
**CC:** John Bosche  
**From:** Kevin Bricknell  
**Date:** 7/25/00  
**Re:** Review of 100 % Design for Settlement, Bearing Capacity, and Oozing Oil

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For this technical review, John examined the following sections from the Final (100%) design Report, Purity Oil Sales Site, Operable Unit Two (OU-2), June 1996:

- ☐ Section 2.5 – Closure cover structural analysis
- ☐ Calculation B-1 – Stability calculation
- ☐ Calculation B-3 – Settlement calculation
- ☐ Calculation B-4 – Bearing capacity calculation

## **Bearing Capacity**

Four feet of soil cover, bridging material, will easily bridge the waste.

## **Settlement**

With eight feet of cover above the surrounding area, and the design predicts 3 inches of settlement, which seems reasonable. The final slope is 8 feet above the surrounding topography and above the waste; the site is 65 miles from a fault, so small chance for slope failure.

The laboratory tests that were ignored (Table 3-8 of Calculation B-3), were those extruding oil; they may cause more than 3 inches; however, not enough settlement to affect the integrity of the cap.



### **Oozing Oil**

Will the 4 feet of fill, dead load, cause the oil to ooze out of the pond? Oil is lighter than soil, so it will go laterally, versus downward. It may be adsorbed. Potential remedial control measures include the following:

- ☐ Sacrificial absorbent to hold x gallons of oil indefinitely
- ☐ Provide lateral containment
- ☐ Collection system around perimeter to collect, and manage oil
- ☐ Excavate oil and place elsewhere; exploratory excavations and backfill with kitty litter - Site characterization on hot spots, if oozing oil; exploratory trench for hot-spot source removal, or just containment. Exploratory trench 10 feet in from the site perimeter. If nothing found, then put in lateral containment along the perimeter (length x depth). Source control may be compatible with the ROD.
- ☐ Treat with some form agent to immobilize oil



TETRA TECH EM INC.

MEMORANDUM

SAN FRANCISCO OFFICE

Date : July 28, 2000

To : Rose Marie Caraway, Work Assignment Manager

EPA Work Assignment No. 030-RXBF-0921

From : Jim Sickles

**Subject : Actions Proposed for Inclusion in Proposed ROD Amendment for Purity Oil Site**

As you requested we have reviewed the *Response to Comments from the May 24, 2000 Meeting, Draft Remedial Action Workplans* (RAWP) received from IT Group dated June 27, 2000 and our notes from the meetings of May 24, 2000 and July 26, 2000 to determine if there are any actions that should be considered in the proposed Operable Unit 2 (OU-2) Record of Decision (ROD) amendment. Based on that review there is three significant issues that should be addressed in the OU-2 soils remedy as currently proposed in the RAWP. The three issues are (1) mitigation of potential migration of tarry sludge beyond the cap; (2) the use of confirmation samples following excavation of offsite contamination to determine residual contamination; and (3) the depth of excavation in the Golden State Market area. These issues have been discussed either in previous comments or meetings however the responses have not adequately addressed the concerns raised. Our recommended approach to addressing these three issues are as follows:

**1. Mitigation of Potential Sludge Migration** – Data from the remedial investigation and the remedial design investigation document the presence of tarry sludge with an in-place viscosity ranging from a free flowing liquid to a tarry viscous sludge the concern is the vertical and lateral migration of this material due to pressure changes created by both changes in load and gas generation due to chemical reactions. The current remedial design would most likely stop the migration through the top and side slopes of the closure cap but would not halt seepage around the toe of the cap. To mitigate this migration we would propose that exploratory trenching be conducted along the north and south boundaries of the site in areas where sludge was encountered in the earlier investigations. If the trenches encountered sludge it should

be removed and placed on the surface if suitable for below the foundation material for the cap. Then the liner to be placed at the base of the side slope should be extended to the bottom of the trench to form a vertical barrier to movement of the sludge. The trenches should be as close as possible to the property line and should extend a vertical depth equivalent to the depth of the original waste ponds.

**2. Confirmation Sampling in those Areas Off Site where Soil is to be Excavated and Placed On Site-**

Those areas off site that have contamination that are proposed have soil excavated and moved onto the site below the foundation material will be excavated to either the current adjacent elevation along the gunite coated slope in the Tall Trees Trailer Park and Bruno's Scrap Yard or a predetermined depth below the surface in the case of the Golden State Market area. Since these areas may contain residual contamination for the purposes of disclosure in regards to future land use confirmation sampling should be conducted.

**3. Depth of Excavation in the Golden State Market Area-**The current RAWP calls for the excavation of soil behind the market to a depth of 4 feet below ground surface (bgs). This will allow the placement of the 4 foot thickness of the closure cap into the excavation while maintaining the current surface elevation. To allow future land use the excavation should be deeper so as to future intrusive activities such as construction and utility maintenance. A depth of 9 feet bgs should be used similar to that used in industrial areas.



TETRA TECH EM INC.

## MEMORANDUM

SAN FRANCISCO OFFICE

**Date** : June 28, 2001

**To** : Rose Marie Caraway, U.S. Environmental Protection Agency, Region IX

**From** : Jim Sickles

**Cc:** Kevin Bricknell, Mark Lewis, and Dan Baker

**Subject** : **EVALUATION OF TWO SUBMITTALS DATED MAY 21, 2001 AND JUNE 5, 2001 IN RESPONSE TO THE STOP WORK NOTICE BY U.S. ENVIRONMENTAL PROTECTION AGENCY, DATED MARCH 20, 2001, FOR THE PURITY OIL SALES SUPERFUND SITE OPERABLE UNIT NO. 2 REMEDIAL ACTION, FRESNO, CALIFORNIA**

An evaluation of the two submittals: (1) "Supporting Documentation for the Request for Variance for the Foundation Layer Soil Material Purity Oil Superfund Site", dated May 21, 2001 and (2) "Follow Up from May 21<sup>st</sup> Meeting,, Purity Oil Sales Superfund Site, Fresno, California prepared by IT Corporation for Chevron Environmental Management Company and submitted to the U.S. Environmental Protection Agency (EPA) Region IX was conducted at your direction. Based on this review we have the following general and specific comments.

### GENERAL COMMENTS:

In both submittal packages our reviewers found the supporting documentation to be weak in justifying the proposals basing the justification on anecdotal "evidence", which was occasionally irrelevant, and sometimes contradictory. Some of this resulted from the documents incorporating information and conclusions contained in previously submitted requests for information (such as RFI No. 14 dated January 14, 2000) and submittals concerning the foundation material and proposed design modifications the proposals can be difficult to follow, particularly for a reviewer unfamiliar with that documentation. The general comments and evaluation of each of the submittals is as follows.

#### "Supporting Documentation for the Request for Variance for the Foundation Layer Soil Material Purity Oil Superfund Site", dated May 21, 2001

Analysis of the first submittal the proposed foundation material when taking into account the previous documentation along with this document indicates that it would be suitable for the purposes of a gas collection layer. However, the change in spacing of the gas collection piping, which is not described in the title or introduction as a design change in addition to the requested change in foundation material, does not appear to be justified by the arguments presented. The change in spacing may be justifiable, but

additional analysis would need to be provided beyond that presented to justify such a change to the original remedial design.

**"Follow Up from May 21<sup>st</sup> Meeting, Purity Oil Sales Superfund Site, Fresno, California, dated June 5, 2001**

The second submittal, the follow up to the May 21<sup>st</sup> meeting included information regarding five items; (1) Liner, (2) Foundation Layer, (3) FID, (4) Railroad, and (5) SAP/QAPP. Analysis of this submittal indicates the following conclusions regarding the following areas:

- (1) **Liner** – The proposed action to address the incompatibility of the proposed HDPE liner with the low pH of the acidic tarry waste by using limestone to adjust that pH to an compatible level appears to be acceptable following the additional submittal of information addressing the compatibility of other materials that could potentially be in contact with the waste beneath the liner. These materials consist of (a) piping being used in the Soil Vapor Extraction (SVE) system and (b) the geosynthetic clay liner (GCL). In addition a installation plan and specifications for the limestone should be provided.
- (2) **Foundation Layer**-The submitted QC tests for the proposed foundation layer material answers some of the questions raised earlier in regards to the physical characteristics of the material but additional information is still required to evaluate the proposed change. This information consists of (a) test results using ASTM Methods D 1557 and D 1140 are necessary to evaluate the material gradation; (b) the permeability results provided differ from those proposed in the previous submittal of May 21, 2001, if the use of this material is proposed based on it's similarity to the material at the Sand Creek Site the gradation of the material at that site needs to be provided as well; and (c) finally is the foundation material to be screened on site at Purity Oil or at the borrow pit and does the borrow pit have enough material to complete the project? A site management plan and specification for the screening will need to be submitted if that is the planned approach, in addition to the test results using the appropriate ASTM methods along with the gradation information for the Sand Creek Site to justify the proposed material.
- (3) **FID Redesign**-The subgrade design elevations plan submitted provides the revised subgrade elevations in the area of the FID pipeline in an attempt to address the relocation of the toe of the slope of the cap resulting from FID's required a 7 foot setback from the centerline of the pipeline. Analysis of the submitted plan indicates that the toe of the side slope of the cap still would be located within the required setback and therefore would not be acceptable unless approved by FID. In addition to correcting the proposed modification, detail drawings of the side slope, anchor trench and drainage swale are necessary to properly evaluate the design modification. In addition a new material balance will be needed to evaluate changes to the QC program.
- (4) **Railroad Redesign**- The subgrade design elevations plan submitted provides the revised subgrade elevations in the area of the railroad right-of-way in an attempt to address the relocation of the toe of the slope of the cap resulting from Railroad's required a 40 foot setback from the railroad track. Analysis of the submitted plan indicates that the toe of the side slope of the cap still would be located outside the required setback and therefore would be acceptable. To complete the evaluation of the proposed modification, detail drawings of the side slope, anchor trench and lower diversion drainage berms and perimeter pipe drains are necessary. In addition a new material balance will be needed to evaluate changes to the QC program.

- (5) **SAP/QAPP** – The submitted document is considered incomplete due the lack of data quality objectives (DQOs) beyond a general description of the process. The DQOs must be developed and presented in the SAP/QAPP for the proposed work. It is problematic to evaluate methods and procedures for the proposed well installation with out first establishing the objectives of the work. Several other inadequacies were found as well, with the major items consisting of (a) the laboratory reporting limits exceed the ROD remediation goals; (b) a method to prevent introduction of contaminated soil to deeper horizons while drilling is absent; (c) detailed soil sampling procedures are not mentioned; (d) PVC well materials may not be compatible with the waste; (e) the methods proposed to establish the well screen depth interval are inadequate along the detailed objectives of where to place the screens; and (f) groundwater sampling should be conducted in accordance with “low-flow” or micro-purge methods. To address these inadequacies requires submittal of a revised SAP/QAPP.

#### **SPECIFIC COMMENTS:**

The specific comments and evaluation of each of the submittals is as follows.

#### **“Supporting Documentation for the Request for Variance for the Foundation Layer Soil Material Purity Oil Superfund Site”, dated May 21, 2001**

Page 2 - 2nd Paragraph - 1st Sentence The objectives discussed for the foundation are to promote drainage and enable effective distribution of vacuum from the SVE system. However it is not noted if that system will be active or passive. The text that follows seems to indicate that it could be either but it should be clearly stated which it is to be or if the material will be sufficient for either. Also it should be noted what criteria would be reviewed to determine which of the two it would be used.

Page 2 - 4<sup>th</sup> Paragraph - 1<sup>st</sup> Sentence It is stated in the text that “For comparison, vertical SVE wells with a 10 foot screen in similar  $1 \times 10^{-3}$  cm/s clean sands produced a flow rate in excess of 500 cubic feet per minute at 6 inches of mercury vacuum during tests of an active SVE system at Sand Creek Superfund site near Denver, Colorado.” To determine the validity of this comparison the characteristics of the material at Sand Creek Superfund Site such as the grain size and permeability would need to be presented and compared with the characteristics of the foundation material being proposed, which has not been done. In addition it is assumed that the material at the Sand Creek Superfund Site is native soil and not a mechanically placed foundation material as proposed. The comparison may or may not be valid but does not appear to be adequately justified in this document.

Page 3 - 2nd Paragraph - 3rd Sentence It is stated that hydraulic conductivities and permeabilities for soil in the range of  $1 \times 10^{-2}$  to  $1 \times 10^{-3}$  cm/s are roughly equivalent to air permeabilities in the range of  $1 \times 10^{-7}$  to  $1 \times 10^{-8}$  cm<sup>2</sup>. Is there a reference to support that statement? Since air permeability data for the material proposed was not provided, this could be significant in evaluating the materials suitability.

Page 3 - 5th Paragraph - 1st Sentence It was proposed that the spacing for the horizontal SVE wells be increased to 80 foot spacing instead of the original 40 foot spacing in the original remedial design. This was based using a radius of influence 40 to 50 feet versus the original design's radius of influence of 20 to 25 feet. Based on the SVE pilot test data IT feels that the larger radius could be used and proposed that 80 foot spacing in the revised Figure H-6 of the revised Remedial Action Work Plan (dated September 20, 2000). At that time since the configuration of the SVE system was presented as conceptual pending the completion of a the pilot SVE test it was assumed that the spacing of gas collection piping would be changed to reflect those results as well. Now that the change in spacing is being formally proposed it is

felt that the design spacing of 40 foot is more appropriate since (1) the system may be passive or active, and (2) this would provide a doubled safety factor.

**"Follow Up from May 21<sup>st</sup> Meeting, Purity Oil Sales Superfund Site, Fresno, California, dated June 5, 2001**

The second submittal included information regarding five items; (1) Liner, (2) Foundation Layer, (3) FID, (4) Railroad, and (5) SAP/QAPP. Analysis of this submittal indicates the following conclusions and required additional submittals regarding the following areas:

**(1) Liner**

**Conclusions**

1. The method of neutralization appears to be appropriate but would require installation of the limestone on all slopes, at a minimum.
2. Due to material compatibility concerns require submittal from gas collection pipe manufacturer that demonstrates compatibility of materials with the site's acidic environment. (Pipe & Geotextile sock)
3. Due to material compatibility concerns require submittal from geosynthetic clay liner (GCL) manufacturer that demonstrates compatibility of materials with site's acidic environment. (Bentonite & Geotextile)
4. Require written analysis by IT as to whether the presence of sulfur compounds in the acidic tarry waste when adding limestone create SO<sub>2</sub> gases and can they impact (1) the effectiveness of the SVE system; (2) the integrity of the liner; (3) will the combination (assuming that it is exothermic) with acidic vapors in other portions of the gas collection piping cause material compatibility problems; and (4) will the resulting changes from the acid with the limestone reduce the permeability of these layers and seal off the subgrade from the gas collection layer designed into the foundation layer

**Required Additional Submittals**

1. Specifications and installation plan for the limestone
2. Submittal from Gas Collection Pipe manufacturer that demonstrates compatibility of materials with the site's acidic environment. (Pipe & Geotextile sock)
3. Submittal from GCL manufacturer that demonstrates compatibility of materials with site's acidic environment. (Bentonite & Geotextile)

**(2) Foundation Layer**

**Conclusions**

1. Testing methods should be ASTM D 1557 (Modified Proctor) and ASTM D 1140 (% Passing 200) for all 3 samples to allow evaluation of gradation as well as permeability.
2. Permeability results provided are less than those proposed in Foundation Layer Variance; in that proposal, the Sand Creek Site is described as having a lower permeability similar to these samples that would work for SVE, does that site's material have the same gradation as the proposed foundation layer material?
3. Does the borrow pit have enough material to complete project?
4. If it is necessary to screen the material would it be done at the borrow pit or at the Purity Oil site?

#### Required Additional Submittals

1. Laboratory test results (proctor and % passing 200 sieve) for 3 samples submitted.
2. Gradation information for the Sand Creek Site
3. Borrow pit investigation report
4. Revised project specifications
5. Site Management Plan/Specifications for screening foundation layer material.

### **(3) FID**

#### Conclusions

1. The toe of the slope still appears to be located in the easement require verification that site does not still fall within 7 foot right of way required by FID.
2. The changes in location of the slope will affect the number of QC samples requiring a new material balance (cut/fill) to be submitted.
3. The changes in location of the slope will require revised site drawings to reflect changes in elevation and detailed drawing for the slope, anchor trench and drainage swale.
4. Since the drainage swale is designed for internal drainage only require verification that the drainage swale along the FID pipe will not create a nuisance through water ponding.

#### Required Additional Submittals

1. Approval from FID that allows site to fall within 7 foot right of way.
2. Revised site drawings
3. Revised material balance

### **(4) Railroad**

#### Conclusions

1. The toe of the slope still appears to be located outside of the easement required by the railroad.
2. The changes in location of the slope will affect the number of QC samples requiring a new material balance (cut/fill) to be submitted.
3. The changes in location of the slope will require revised site drawings to reflect changes in elevation and detailed drawing for the slope, anchor trench and drainage berms and perimeter drains.
4. The location of the easement on the site property require verification that the redesign would allow room on the edge of the site inside of the property line for the lower diversion drainage berms and perimeter pipe drains

#### Required Additional Submittals

1. Verification that the drainage berms would be allowed on the Railroad's easement as long as it is on the site property.
2. Revised site drawings
3. Revised material balance

### **(5) SAP/QAPP**

#### Conclusions

1. The responsibilities of the project geologist should include interpretation of borehole logs and determination of well screen placement to meet objectives of the program. QAPP 2.4
2. It is stated that well installation is scheduled to occur after DQOs are completed and approved by the EPA. DQOs are absent from this document and they must be developed and presented in a



FSP/QAPP for the proposed work. It is problematic to evaluate methods and procedures for the proposed well installation without first establishing the objectives of the work. QAPP 4.0

3. Laboratory reporting limits exceed the ROD remediation goals. In all cases, the reporting limits must be within the ROD remediation goals. QAPP 5.6

4. DQOs are necessary but absent from the FSP. 1.0

5. A method to prevent introduction of contaminated soil to deeper horizons while drilling is absent. Since the borings are to be advanced through contaminated soil, a method such as casing off the contaminated horizons prior to advancing the boreholes to greater depths should be employed. FSP 4.0

6. Detailed soil sampling procedures (split spoon) are not mentioned in the document. Please provide an SOP for this work (ASTM recommended). FSP 4.0

7. PVC well materials may not be compatible with the waste. Provide an analysis or justification for use of this material. FSP 4.2.1

8. It is stated that well screen intervals will be chosen based on the lithologic log. The methods proposed to establish the well screen depth interval are inadequate. Visual and field classification of the soil will be helpful, but split spoon sampling alone will not allow a detailed continuous log depicting changes in hydraulic conductivity to be developed. In addition to the split spoon sampling, the boreholes should be logged with a cone-penetrometer instrumented with a pore pressure measuring device. In addition, more detailed objectives of where to place the well screens should be established. FSP 4.2.1

9. Groundwater sampling should be conducted in accordance with "low-flow" or micro-purge methods. The methods proposed do not specify how the water will be obtained from the wells other than "directly from the discharge line". FSP 4.5.2

10. The bentonite seal thickness is shown to be in excess of 20 feet. Figures 3&4

#### Required Additional Submittals

1. Require submittal of revised QAPP with site specific DQOs provided rather than simply describing the process.

2. Require submittal of revised QAPP addressing responsibilities of geologist to interpret bore logs and determine placement of screen levels and revise reporting limits of analytical protocol to meet ROD remedial goals

3. Require submittal of revised QAPP to address methods and procedures to install monitoring wells to meet DQOs provide in the revised QAPP.

4. Require submittal of revised FSP to provide (1) a method to prevent introduction of contaminated soil to deeper horizons while drilling; (2) a detailed soil sampling procedures (split spoon) such as ASTM SOP; (3) provide an analysis or justification for use of PVC material; (4) provide for the use of a cone-penetrometer instrumented with a pore pressure measuring device, in addition to the split spoon sampling and detailed objectives of where to place screens; (5) a groundwater sampling method using low-flow methods.

5. Require submittal of revised figures 3 and 4 with appropriate bentonite seal thickness

**DRAFT**  
**SOLIDIFICATION/STABILIZATION AND LIMESTONE ISSUES CHRONOLOGY**  
**PURITY OIL SALES SUPERFUND SITE**  
**FRESNO, CALIFORNIA**

Based on a preliminary file review of the Limestone Issues regarding the Bearing Capacity, pH, Limestone Installation and Slope Solidification/Stabilization Concerns, the Chronology are as follows:

**Bearing Capacity and pH:**

**11/9/94** – While reviewing the Pre-Design and Remedial Design Work Plan EPA asks the following question: “EPA presumes that the behavior of the Layer B material under the stress of the cap will be considered”.

**05/2/96** – While reviewing the Pre-Final Design (90%) text EPA asks the following question: “Please also see comment 20 in our letter to you dated December 14, 1995. We are not convinced that the designer has adequately considered for possible settlement of the waste pit material, especially due to significant voids that may surround the buried construction rubble. We are not convinced that compaction of the foundation layer will adequately compact the waste layer.”

The multiple “geo” layers require more detailing. One EPA expert with whom I consulted indicated that perhaps all layers should be carried through the “anchor trench”. Each section should provide a reference to where more details can be found.”

Smith’s response:

...”The flexible membrane liner and drainage layers cannot be continued throughout the anchor trench and down the slope of the cover because by doing so, we would be de-stabilizing the slope. By including the geosynthetics on the slope, we would be introducing a low friction resistant failure surface into the design which could lead to slope failures.”

**12/10/98 – Chevron’s Response Submittal** – Chevron submitted responses to comments on the Draft Remedial Action Workplans, dated August 5, 1998 and comments prepared by CH2M Hill on November 16, 1999.

EPA commented “that past data shows that waste has overflowed onto the boundaries of the trailer park and Bruno’s scrap yard. As a short term protective measure, DTSC installed gunite on the slopes between the trailer park and the Purity Oil Site during 1984. Waste material was on the exposed slopes prior to the implementation of the gunite.”

EPA also state that “during the 1984 Harding Lawson (contractors for DTSC) placed gunite over the slopes adjacent to the trailer park that had exposed oily waste (see Figure 1-8 in RI).

Waste extends more than five feet onto Bruno's property, due to past flooding. There is also a high probability that waste may be located at least five feet onto the trailer property. Chemical analyses indicate that the waste is high in lead and certain organic compounds. The pH of the tarry waste is as low as 1.9."

In addition, EPA stated that "along certain portions of the site, the maximum perimeter slopes will be 3(horizontal): 1(vertical) and will also be covered with a 3-inch thick reinforced concrete layer to minimize infiltration and prevent viscous materials from permeating through the closure system. Seeps have been occurring behind Trailer #7. Provide a description of how a 3-inch thick layer could still be protective and prevent infiltration. Maybe the thickness of the concrete layer should be increased on the slope areas.

**04/17/00 – Meeting with EPA (Rose Marie, Jim Sickles, Bill Mabey)**

Tetra Tech expressed concern for future site settlement.

Tetra Tech expressed concern for sludge seeps "ooze".

**05/10/00 – Meeting with Chevron, IT Corporation, EPA, and Tetra Tech**

EPA expressed concern over tar seep in Tall Trees Trailer Park, and that it has been occurring a decade or longer. (IT states approximately <1 liter/month)

EPA concerned about how much sludge remains within the site.

**05/24/00 – Meeting with EPA and IT Corporation**

EPA expressed concern over the tar seeps on the perimeter slopes and potential for future movement.

EPA also expressed concern over potential settlement of the cap and the side slopes ability to hold in the sludge/tar.

IT Corporation proposes to place a woven geotextile (Mirafi) over soft spots and areas that exhibit excessive pumping.

EPA asks if HDPE will react with acidic sludge and if HDPE will "keep sludge in".

**07/00 – Future Meeting (Status of Remedial Design Issues to be Discussed):**

Unresolved items such as Cap Integrity, Settlement Design, and Mitigation of Sludge Migration to be discussed.

**07/25/00 Meeting with EPA and IT Corporation**

EPA concerned about sludge movement

Discuss options for the following:

- Treatment
- Containment
- Absorbent
- Collection System

**07/25/00 – Memo** – An interoffice memo was prepared regarding the oozing oil along the perimeter slopes. It was concluded that the soil should be treated with some form of agent to immobilize the oil.

**07/28/00 – Memo** – As per EPA's request, Tetra Tech submitted a memo regarding actions proposed for inclusion in Proposed ROD Amendment. The *Response to Comments from the May 24, 2000 Meeting, Draft Remedial Action Workplans* (RAWP) received from IT Group dated June 27, 2000 and notes from the meetings of May 24, 2000 and July 26, 2000 were reviewed to determine if there were any actions that should be considered in the proposed OU-2 ROD amendment. Based on the review there were significant issues addressed in the OU-2 soils remedy as currently proposed in the RAWP. One of the issues was the mitigation of potential migration of tarry sludge beyond the cap. Data from the remedial investigation and the remedial design investigation document the presence of tarry sludge with an in-place viscosity ranging from a free flowing liquid to a tarry viscous sludge. The concern was the vertical and lateral load of the planned cap. The cap will add some additional pressure on the sludge, which in turn may change the viscosity of the sludge, or the rate of gas-generating chemical reactions. Generated gas may in turn displace sludge out of void spaces in the soil thereby inducing sludge migration. To mitigate this migration, an exploratory trench was proposed along the north and south boundaries of the site in areas where sludge was encountered in the earlier investigations.

**08/1/00 Meeting with EPA and IT Corporation**

Concern about continued sludge/tar seeps on perimeter slopes  
EPA states "known seepage=known risk"

**10/31/00 – Foundation Layer Specification:**

Specification needs to provide bearing; bridge gaps and provide voids for viscous materials thereby reducing the potential for settling and permeation of viscous substances; and act as a gas vent permeable layer and not get plugged up by fines less than #100 sieve size.

**11/3/00 Project Meeting (Purity Site)**

Concern about continued sludge/tar seeps on perimeter slopes. IT Corporation proposes to install a woven geotextile over sludge/tar seeps.

**11/10/00 Project Meeting (Purity Site)**

Proposed foundation material testing is done except for CaCO<sub>3</sub> test and is expected to be submitted to TTEMI on 11/13. Looking at two area pits on the north and on the south sides of the site.

**11/17/00** – concern over presence of carbonate in soils which could result in subsidence and gas formation – recommended avoiding carbonate soils.

**11/30/00** – recommended that carbonate in soils be maximum of 5% with no contact between oily waste and foundation layer.

**12/1/00 Project Meeting (Purity Site)**

Concern about continued sludge/tar seeps on perimeter slopes. Proposal to over-excavate sludge/tar seeps and soft slope soils and backfill with foundation layer materials.

### **12/8/00 Project Meeting (Purity Site)**

Concern about continued sludge/tar seeps on perimeter slopes. IT Corporation proposal to excavate sludge/tar seeps, place a woven geotextile, and backfill with foundation layer materials.

Concern that large pools of acidic sludge/tar remain within the site

Concern about the possible "wicking effects" that could occur with the woven geotextile and the acidic liquid.

Proposal for some type of "buttress" for the sludge/tar seeps

Proposal to install settlement monuments to determine if site is moving.

### **12/15/00 Project Meeting (Purity Site)**

Concern about continued sludge/tar seeps on perimeter slopes.

Proposal to remove 1 foot of effect slope soils at toe of slope, place woven geotextile (Mirafi 600) then place foundation layer materials.

Compaction cannot achieve in areas where identifiable sludge/tar seeps are located.

concerned that sludge/tar seeps have a pH of approximately 1.

concerned about structural stability of north slope, discuss a "receptor trench" for the acidic liquids be installed at the toe of the north slope.

**12/29/00 – Revision to the RAWP (OU-2)** – EPA comment #17 – Provide a new figure to document that along the perimeter of the cap an anchor trench will be dug to the depth of known occurrences of waste based on Remedial Investigation and Remedial Design information available. Tetra Tech agreed with depths ranging from 2 to 4 feet below the perimeter lines. In that case, the cap may have to cross property boundaries or the waste brought back on site. Agreed Resolution – "Agreed".

### **01/04/01 Project Meeting (Purity Site)**

IT Corporation will bring out Sunil Kishnani (PHD Civil Engineer) to look at perimeter slopes and present a recommendation to EPA to address EPA concerns.

EPA proposes excavating test pits in sludge/tar seep areas.

### **03/20/01 Stop Work Letter**

EPA issued a Stop Work Letter to Chevron on March 20, 2001 that required Chevron to address several issues that were not in compliance with the "conditionally approved" RAWP.

**04/02/01 – IT's Slope Stability Analysis Submittal** – IT prepared a Slope Stability Analysis report on behalf of Chevron to report results associated with the design analysis of the soils operable unit. This slope stability analysis was conducted at the request of Tetra Tech EM Inc. in an email, dated February 28, 2001. The results gathered from this design analysis were used to evaluate the static and seismic stability of the most critical side slopes of the site as graded for closure and with the closure cover installed.

**05/9/01** – Expressed concern over low pH oil seeps and materials – GSE states that HDPE is good to pH of 1 but if below that it is of concern – suggested a 2 liner system with a drainage net between – GCL will fail if comes into contact with oily waste.

**05/21/01 – Evaluation of Submittal** – A meeting was held on May 21, 2001 at EPA Region IX Headquarters with Chevron, IT Corporation, EPA and Tetra Tech EMI to discuss the Purity Oil Sales Superfund site and STOP WORK letter issued on March 20, 2001. 7 major issues were discussed:

- (1) Golden State Market
- (2) Off-Property Contamination
- (3) Foundation Layer
- (4) Geosynthetic Components (Compatibility with Acidic Waste)
- (5) Re-design of site in relation to FID pipeline
- (6) Re-design of site in relation to BNSF railroad
- (7) SAP/QAPP for the installation of monitoring wells and SVE wells.

Chevron was asked to submit information to the EPA on items 3-7 by June 1, 2001. Items 1 & 2 require additional discussion between EPA and Chevron.

On June 5, 2001, IT submitted information on items 3-7.

**05/31/01 – Email** - IT sent an email to Serrot (Geosynthetic Manufacturer) and stated that “ A litmus paper test of the liquids next to some of the tars indicate a pH of 1 (or less). Is the HDPE compatible for this material?”

Serrot responded by submitting Serrot Technical Note - #9/HDPE Chemical Compatibility which stated that “Acids such as concentrated nitric, phosphoric or sulfuric acid are also oxidizers but different acids have different characteristics. The manufacturer should be consulted if a liner is going to be used in containing a solution with a pH of less than 2.

**05/31/01 – Memo** – IT sampled sludge and sent sludge samples to IT Technology Development Laboratory for Neutralization Treatability testing. IT Technology Development Laboratory tested the sludge with the following reagents:

<u>Reagent:</u>	<u>%/Weight:</u>	<u>pH:</u>
(1) Portland Cement	35% & 45%	10.16 & 10.82
(2) Limestone	40% & 50%	3.34 & 3.83
(3) Lime Kiln Dust	35% & 45%	11.06 & 11.59
(4) Cement Kiln Dust	35% & 45%	4.54 & 4.44
(5) Quicklime	20% & 30%	11.85 & 11.93
(6) Fly Ash (Class C)	35% & 45%	3.70 & 3.97
(7) Hydrated Lime	30% & 40%	7.24 & 9.80

As a result, IT Technology Laboratory recommended the use of limestone ( $\text{CaCO}_3$ ).

**06/05/01 – Evaluation of Submittal - Action Items based on IT's submittal regarding Liner and Acid Compatibility:**

- (1) Installation of the limestone on all slopes, at a minimum.
- (2) Submittal from Gas Collection Pipe manufacturer that demonstrates compatibility of materials with the sites acidic environment. (Pipe and Geotextile Sock)
- (3) Submittal from GCL manufacturer that demonstrates compatibility of material with sites acidic environment. (Bentonite & Geotextile)
- (4) Does the presence of Sulfur compounds in the acidic tarry waste when adding Limestone create SO<sub>2</sub> gases and can they impact (1) the effectiveness of the SVE system; (2) the integrity of the liner; (3) will the combination (is this exothermic?) with acidic vapors in other portions of the gas collection piping cause material compatibility problems; and (4) will the resulting changes from the acid with the limestone reduce the permeability of these layers and seal off the subgrade from the gas collection layer designed into the foundation layer.

**06/28/01 – Memo** – As requested by EPA, Tetra Tech submitted a memo "Evaluation of Two Submittals dated May 21, 2001 and June 5, 2001 in response to the stop work notice by U.S.EPA, dated March 20, 2001. The proposed action to address the incompatibility of the proposed HDPE liner with the low pH of the acidic tarry waste by using limestone to adjust that pH to a compatible level appears to be acceptable following the additional submittal of information addressing the compatibility of other materials that could potentially be in contact with the waste beneath the liner. These materials consist of (a) piping being used in the Soil Vapor Extraction (SVE) system and (b) the geosynthetic clay liner (GCL). In addition, an installation plan and specifications for the limestone should be provided.

**07/19/01 – Submittal** - Chevron submitted the response to the U.S. EPA's letter of July 5, 2001 stop work issues sent by J. Truskey to D. Rabbino. Chevron responded by:

- (a) "The bench tests performed by IT demonstrate that the application of the lime layer in selective locations will buffer the pH to above 2.5. The HDPE membrane liner is compatible with pH in this range. The piping for the horizontal wells will be HDPE, which has the same characteristics as the liner membrane material."
- (b) "IT will install Bentofix. A phone conversation with Mr. Graydon Renshaw of Serrot International, Inc. geosynthetic supplier for the Purity Oil project (800-323-3836), recommended using a special scrim reinforced GCL coated with a low permeability polypropylene membrane."
- (c) "The installation plan for the lime is to place with a loader a 4 to 6 inch layer of ½ inch limestone on the side slopes as necessary where low pH tar seeps are evident, and a strip 36 inches wide on the subgrade, immediately under the horizontal SVE horizontal pipes." It was then discussed that the term "as necessary" needs to be quantified as much as possible ahead of time.

A synopsis of this evaluation was presented to Chevron as a single-page punch list of key issues by EPA during a meeting on August 2, 2001.

### **8/02/01 – Meeting**

Submittals required and subgrade work to be conducted was discussed.

IT to provide a revised schedule showing all remaining components of OU-2, including, the SVE system, eleven groundwater monitoring wells to be installed, rehabilitating the existing extraction wells, groundwater collection & treatment system operation, and a borrow source report for RMC.

Subgrade items such as the excavation of all contaminated material identified during the anchor trench excavation and the placement of limestone on the entire length of the northern, western, and southwestern slopes.

**9/12/01 – RFI Submittals** – RFI No. 24 (Changes to the Geosynthetic Liner Materials) and RFI No. 25 (Use of Geocomposite Layer for SVE System Collection) were submitted.

**09/19/01 – City of Fresno Complaint** (Refer to 12/07/01 comments).

On September 19<sup>th</sup>, 2001, a customer visiting the Golden State Market notified the Fresno Community Health Service of noxious odors coming from the Purity Oil Sales Superfund Site. The customer complained of being nauseated and having throat irritation after being exposed to the noxious odors.

The Fresno County Fire Department's Hazardous Materials' Team and the Fresno Community Health Service were dispatched to the site to investigate the complaint. Rose Marie Caraway (EPA) was also notified of the incident by the Fresno Community Health Service. The Fresno County Fire Department's Hazardous Materials' Team monitored the area, prior to entering the site, for combustible constituents and for Sulphur Dioxide.

After the initiation of engineering controls (odor suppressant) to mitigate any future emissions from the site, by IT Corporation, the Fresno Community Health Service and Fresno County Hazardous Materials' Team left the Purity Oil site.

The source of the odors was found to be the acidic tar that was discovered in the Perimeter Exploratory Anchor trench.

**09/26/01** – EPA provided SECOR with written approval for RFI No. 24, 25 and 26. The written approval for RFI No. 26 clearly stated, "If anomalous low strength materials are discovered during construction, the stability analysis should be reevaluated". Secondly, this approval suggested that the project should include a geotechnical oversight program to verify that the parameters that IT assumed in their design were accurate.

**10/04/01** – A large area of acidic tar was discovered at the toe of the north slope, adjacent to the Purity Oil, Tall Trees Trailer Park, and Golden State Market property lines. The acidic tar extended into the Tall Trees Trailer Park, which was observed during the Perimeter Exploratory Anchor Trench excavation. Video documentation of this area was performed by EPA and Tetra Tech.



**10/07/01 – Tetra Tech EMI Memo to EPA** – To achieve the elevations and grades depicted on Drawing 7A included as part of RFI No. 26, several tar seeps have appeared at the toe of the North Slope during excavation activities (Pictures were taken on this date). As part of Tetra Tech's letter to SECOR on September 26, 2001, "Review of RFI No.'s 24, 25 (Rev. 2) and 26", Tetra Tech stated that, "If anomalous low strength materials are discovered during construction, the stability analysis should be reevaluated".

**10/10/01** – On October 10, 2001, Tetra Tech issued a letter to SECOR regarding the stability of the north slope due to the consistent appearance of tar seeps ("anomalous low strength material"). The slope stability analysis presented in RFI No. 26, utilized unit weights for the cover system, waste layer, and subsurface layers of 115 pounds per cubic foot (pcf), 107 pcf and 106 pcf, respectively. The unit weight of the waste layer utilized in the slope stability analysis differed from the unit weight of 71.8 pcf, determined by IT's Technology Development Laboratory in the "Bench Neutralization Test of the Tar Seep Material from the Purity Oil Site," which was performed in May 2001. Because of the vastly differing unit weights of the waste layer, EPA questioned the validity of IT slope stability analysis.

**10/15/01** – IT's Quality Assurance Engineer, Dr. Sunil Kishnani, P.E., requested that test pits be excavated into the slopes, around the entire site. These test pits clearly identified large volumes of debris and that tarry waste was present.

**10/17/01 – Project Meeting** – EPA, Tetra Tech, SECOR and IT discussed utilizing lime as a solidification agent for the soft areas on the perimeter slopes. IT's QA engineer stated that this procedure would tighten up the soft spots on the perimeter slopes and eliminate the need to test the perimeter slopes.

The EPA asked IT to submit a detailed solidification/stabilization procedure. The EPA requested that the procedure include the following: (1) areas requiring solidification/stabilization, (2) How deep each grid will be treated, (3) debris removal procedure i.e. material that will be removed and debris that will remain, (4) mix design, and (5) QA/QC procedures. Once the procedure is approved, a treatment demonstration will be conducted on some of the worst areas.

**10/23/01 - Slope Solidification/Stabilization Concerns:**

IT proposes quicklime and pilot test.

IT proposed the Perimeter Slope Subgrade Solidification Procedure based on discussions between representatives of EPA, Tetra Tech, SECOR (10/17/01 only), and IT Corporation, on October 15 and 17, 2001. Also, as discussed in IT's proposal, "The presence of soft tarry waste, contaminated soil material, iron, steel, and large concrete construction debris in the subgrade, "soft" spots have been observed on the subgrade of the perimeter slopes. In addition, due to the presence of these materials, it has been difficult to accurately test the compaction of the subgrade."

**10/24/01 – RFI Submittal** – IT submitted RFI No. 27 (Proposed Change in Subgrade Specifications) and RFI No. 28 (Perimeter Slope Subgrade Solidification Procedure). The Slope Solidification Procedure was proposed because IT was unable to meet the compaction

requirements (all excavations and fill materials of the subgrade layer), as required by the project specifications, for the perimeter slopes.

**10/25/01 – Treatment Demonstration with Quicklime** – IT and their earthwork subcontractor conducted a treatment demonstration, utilizing Quicklime, on three grids that contain soft areas on the North Slope.

During the treatment demonstration, a release of dust and steam formed a cloud, with a height of 100 to 125 feet which left the Purity Oil Sales Superfund Site. IT Corporation notified the adjacent property owner (Bruno's) to notify them that it was steam and was not of any concern. At approximately 12:45 p.m. a second release was observed and once again left the site towards Bruno's.

Shortly after the second release, Randy Tosi (Bruno's) came to the site and complained about material settling on his site and that he was also concerned about the safety of his workers.

On October 29<sup>th</sup> an employee of Bruno's Scrap Yard complained of having respiratory type problems over the week-end. EPA contacted the IT Group and required them to ensure that the employee received appropriate medical care that was caused by the October 25<sup>th</sup> release. Refer to 10/29/01 for further detail.

**10/29/01 – Bruno's Scrap Yard Employee Complaint** – Tetra Tech was contacted by EPA that an employee working at the Bruno's Iron and Metal yard located north of Purity was complaining of medical symptoms that the employee attributed to exposure to the dust and fumes associated with the solidification/stabilization activities performed at Purity on October 25, 2001. Representatives of Tetra Tech and SECOR went to Bruno's and met with Mr. Randy Tosi. Mr. Tosi stated that one of his employees was complaining of symptoms that he attributed to the inhalation of the dust and fumes coming from Purity on October 25, 2001. Mr. Tosi was also concerned with the "white dust" on some of his scrap metal, and was also concerned with his customers.

#### **11/01/01 – Project Meeting and Submittals:**

IT and SECOR also submitted the following information on November 1, 2001; (1) Summary of Field Plot Solidification Tests (2) Corrective Action for subgrade solidification procedures. Also, on November 1, 2001, EPA, Tetra Tech, SECOR and IT discussed the slope solidification procedures. The EPA was concerned about emissions from the lime mixing. IT suggested Portland Cement as an alternative to lime. Based on the discussion, IT was to prepare a new solidification procedure using Portland Cement slurry as the reagent as recommended by Mr. Paul Lear of IT, and (3) Valley Industrial & Family Medical Group incident report for a Bruno employee.

**11/01/01 – Memo** - Tetra Tech prepared a memo documenting the cleared future well locations. A brown bubbling liquid was observed from CIX-7. Cross-sections and photographs of the subsurface conditions observed while excavating the future well locations have been filed.

**11/07/01 – Project Meeting** – An on-site meeting was held between IT, SECOR and Tetra Tech to observe the excavation of the test pits in the north and west slopes and for IT to propose a subgrade solidification procedure.

**11/08/01 – IT and SECOR Submittal** – IT and SECOR submitted the Perimeter Slope Subgrade Solidification Procedure.

**11/13 and 11/14/01 – IT Submittals** – The proposed Supplemental Air Monitoring Approach and the Perimeter Subgrade Solidification Procedure were submitted.

**11/19/01** – IT submitted a revised Slope Solidification Procedure based on the discussions held during the meeting conducted on November 15, 2001. Tetra Tech then forwarded the revised procedure via fax to EPA on November 20, 2001. Tetra Tech informed IT that the Contingency plan was required as part of the Slope Solidification Procedure before night activities could begin, and a Supplemental Air Monitoring Plan would be required if IT elected to work during the day. Both plans would have to be approved by EPA before Slope Solidification activities could commence. A revised response was not submitted by IT to EPA and Tetra Tech during the 11/19-11/25/01 reporting period regarding the two plans.

**11/26/01** – IT submitted the Perimeter Slope Subgrade Solidification Procedure.

**11/27/01** – IT submitted the Perimeter Slope Subgrade Solidification Emergency Response Plan and Contingency Procedures which was required as part of the 11/26/01 submittal before field work can commence. Also, according to IT, on November 27, 2001, Technicon tested the compaction of the subgrade on top of the site from the center point to the west and all of the tests passed.

**11/28/01 – IT's Perimeter Slope Subgrade Solidification Procedure:**

Tetra Tech (Purity Site) received the Perimeter Slope Subgrade Solidification Procedure (issued on November 19, 2001) and a conference call was conducted between EPA, Tetra Tech and IT on November 20, 2001.

Based on discussions between representatives of EPA, Tetra Tech, SECOR and IT, on November 1, 8 and 15, 2001, the following procedure was developed to address the presence of seeps.

The procedure will be verified, and, if necessary, modified depending on the results of the test. The test will be in-situ mixing area directly on the slope, where the Portland Cement slurry will be mixed into the soft material. Full grids will be selected to facilitate management of the test.

**11/29/01 – EPA's comments to the Perimeter Slope Solidification & Contingency Procedure:**

EPA submitted comments to IT regarding the Perimeter Slope Solidification Procedure, the Perimeter Slope Subgrade Solidification Emergency Response Plan and Contingency

Procedures, a table entitled "Action Levels Established for Excavation/Handling of Petroleum Contaminated Soil" and the Slope Solidification Log.

**12/05/01 – IT's RFI No. 28, Rev. 1 Submittal regarding the Perimeter Slope Subgrade Solidification Procedure:**

IT submitted RFI No. 28, Rev. 1 based on EPA's comments on 11/29/01. RFI No. 28, Rev. 1 was developed and submitted to address the solidification of soft areas on the perimeter slope. In addition, this procedure addresses the presence of seeps.

**12/07/01 – SECOR met with the City of Fresno to inform him of the Slope Solidification and Stabilization activities to be conducted at night and also provided air monitoring data collected on September 19, 2001. Also, Tetra Tech and EPA held a conference call to discuss RFI No. 28.**

**12/13/01 – EPA's comments to RFI No. 28, Rev. 1:**

EPA submitted comments to SECOR (subcontractor authorized, on behalf of Chevron) regarding the Perimeter Slope Solidification & Contingency Procedures. EPA requested that IT should incorporate the comments and submit as RFI No. 28 Rev. 2 for EPA review. SECOR also submitted the revised Public Notice on this date.

**12/17/01 – IT's RFI No. 28, Rev. 2 and Rev.3 Submittals:**

IT submitted RFI No. 28, Rev. 2 and Rev.3 to address EPA's comments from RFI No. 28, Rev.1 submitted on December 13, 2001. After numerous meetings, and numerous changes to the slope solidification procedures, and reagents, due to IT's (Chevron's subcontractor) inability to handle the reactions and fugitive emissions, SECOR, on behalf of Chevron, submitted RFI No. 28, Rev. 3. RFI No. 28, Rev. 3, utilized Portland Cement slurry instead of quicklime, to try and control the heat of reaction and the fugitive emissions.

IT stated that the presence of soft tarry waste, contaminated soil, iron, steel, wood, and large concrete created "soft" spots in the subgrade of the perimeter slope. When the subgrade was tested for compaction using compaction tests defined in the QA/QC table of the RAWP, it failed. The diverse nature of these subgrade materials made it difficult to accurately test the compaction of the subgrade using the defined compaction test methods.

**12/27/01 – EPA's Approval of RFI No. 28, Rev. 3:**

EPA submitted the approval of RFI No. 28, Rev. 3, Proposed Perimeter Slope Subgrade Solidification Procedure, to SECOR.

**01/10/02 – Tetra Tech was notified by IT that the Perimeter Slope Solidification/Stabilization field activities will not begin due to their on going financial problems.**

**01/14/02 – SECOR submitted Limestone Placement (Memo 115) to replace Memo No. 106.**

**01/16/02 – IT filed for Chapter 11 Bankruptcy Protection.**

**01/17/02** – Tetra Tech received the compaction data for the exploratory trench backfill and the subgrade construction.

**01/25/02** – Tetra Tech sent an email to IT regarding the subgrade compaction data, requesting information not provided by IT in their January 17, 2002 submittal package. A meeting had been scheduled for January 29, 2002 to discuss Compaction Data.

**01/29/02** – Tetra Tech met with IT at the site to review and discuss the January 17, 2001 cover letter and table submitted along with the subgrade compaction data.

**01/31/02** – Tetra Tech met with EPA at the site to review and discuss the Subgrade Compaction Data (Initial Evaluation).

**02/11/02** – IT hand delivered copies of the subgrade compaction field sheets to Tetra Tech's San Francisco office which were not legible in the January 17, 2002 submittal package. However, after review of the February 11, 2002, submittal package, there were still field sheets which were not legible.

**02/13/02** – EPA and Tetra Tech conducted a meeting (San Francisco office), to review the Initial Evaluation of the Subgrade Compaction Data and the current site status.

**02/24/02** – Tetra Tech contacted IT and informed them that the subgrade compaction testing data (field copies) was still not legible and requested that legible copies be provided. SECOR was also informed during this time regarding this data.

**03/13/02** – EPA submitted a letter to Chevron to hire a new subcontractor.

**03/15/02** – EPA sent an email regarding a meeting to be held with EPA, Chevron, and possibly Tetra Tech and SECOR.

**03/22/02** – SECOR met with Tetra Tech to discuss the remedies for Purity and also conducted a site walk to help assist SECOR's proposal to be submitted to Chevron.

**03/26/02** – Tetra Tech contacted SECOR and informed them of the Geosynthetic requirements (RFI's 24, 25 and 26).

**03/29/02** – ChevronTexaco, SECOR and Tetra Tech conducted a site walk and discussed the tasks to be completed.

**04/18/02 – Project Meeting/Conference Call:**

SECOR stated that they will be conducting the site work in accordance with the 100% Design, Project Specifications, Remedial Action Work Plan, Consent Decree, and Approved RFI's submitted by IT Corporation. SECOR requested that the RFI's be change to RFV's. SECOR to submit RFV's to address (1) Slope Solidification/Stabilization (2) Horizontal and Vertical Tolerances during construction and (3) Pilot Study. SECOR asked about the compaction data. Tetra Tech asked SECOR if they had reviewed that data. SECOR stated "No". Tetra Tech once

again asked SECOR to review the data so that EPA, Tetra Tech and SECOR could discuss a course of action.

**04/23/02 – SECOR’s RFV No. 1 Submittal/Perimeter Slope Solidification Procedure (RFI No. 28, Rev. 3):**

“SECOR requested a variance to the Perimeter Slope Subgrade Procedure as presented in RFI No. 28, Rev.3, which was submitted by IT and subsequently approved by EPA. As no previous requirement exists in the CD, 100% Final Design or SOW, SECOR has reviewed all available information generated by the previous contractor, which includes the following documents: RFI No. 28; RFI No. 28, Rev. 1; RFI No. 28, Rev. 2; RFI No. 28, Rev. 3, EPA comments which address these documents, and a summary of the previous contractor’s attempts to stabilize the slopes”.

“In evaluating the Portland Cement Stabilization method, SECOR has found evidence that this method will not be effective at the Purity Site. An EPA demonstration using Portland Cement for stabilization of acidic petroleum sludges at the Douglassville Superfund Site in Pennsylvania failed to adequately stabilize the sludge and the ROD was changed to allow for quicklime stabilization. The Portland Cement method attempts to stabilize sludge by creating micro-cementation, which produces a temporary strength for undisturbed sludge, but the sludge will turn flowable when mixed or disturbed. Therefore, SECOR evaluated using quicklime to stabilize the Purity sludge. Quicklime treatment works by chemical stabilization reactions as opposed to micro-cementation bridges that are destroyed when agitated. Quicklime treatment has been used successfully by SECOR at other sites for the stabilization of petroleum-impacted soils and sludges”.

“Upon becoming the supervising contractor, SECOR conducted bench-scale tests to evaluate quicklime as a stabilizing agent that would address the concerns associated with this task, specifically, establishing a surface capable of supporting the closure cover, reducing the acidic nature of the tarry waste to help eliminate impacts to the liner materials, and limiting the mobility of the waste materials”.

**04/25/02 – Tetra Tech Memo** – As ambient air temperatures continue to increase, several tar seeps have surface on the north slope. A site map illustrating the approximate position of these tar seeps, and a set of digital photographs which documents the location and size of the tar seeps on this date were recorded and filed.

**05/02/02 – EPA Evaluation of Perimeter Slope Solidification & Contingency Procedures:**

EPA submitted comments to RFV No. 1 and requested that SECOR incorporate the comments and submit as RFV No. 1, Rev. No.1. The objective was to determine if SECOR’s request meets/or exceeds the approved IT’s perimeter slope solidification procedure (RFI No.28, Rev.3).

EPA also mentioned in this letter that they will not approve the initiation of placement of the foundation layer until the following items are completed (1) the slope stabilization is completed and approved by EPA for all effected grids and (2) all applicable compaction test data (including

previous and outstanding test data) for the top and sides of the cap have been submitted, evaluated and approved by EPA.

**05/08/02 – Project Meeting (Purity Site):**

EPA, Tetra Tech and SECOR were present during this site meeting. EPA informed SECOR that a thorough review of RFV No. 1 was underway at this time. EPA has contacted the Remedial Project Manager of the Douglassville Superfund Site in Douglassville, PA. and has identified several discrepancies with SECOR's proposed approach and the remedial action that was implemented at the Douglassville site. The discrepancies identified thus far are: (1) Lime Kiln Dust was utilized at the Douglassville site, not quicklime, and (2) Portland Cement was never considered as a reagent for the Douglassville site.

SECOR asked EPA if they want to use cement slurry as previously proposed by IT in RFI No. 28, rev.3. EPA stated that they are not concerned about the reagents, but is more concerned about the approach. EPA also stated that when work is performed, the EPA wants it to be a permanent fix. In addition, EPA stated that, at a minimum, 2 feet on the south slope would require stabilization and 3 feet on the north and west slope would require stabilization.

EPA also stated that all perimeter slopes will require treatment, not just areas where visible sludge is identified, as stated in RFV No. 1. SECOR stated that they were going to use any reagent necessary (i.e. sand), not necessarily quicklime, to get slopes to meet compaction. EPA stated that since compaction was not achievable on the perimeter slopes, treatment of all perimeter slopes is required, once an acceptable approach has been agreed upon.

**05/13/02 – Project Meeting (Purity Site):**

EPA, Chevron, Tetra Tech and SECOR were present during this site meeting. Chevron asked EPA if RFV No. 1 was being reviewed by EPA and their subcontractor (Tetra Tech). EPA stated that RFV No. 1 was being reviewed by EPA Land Remediation and Pollution Control Division, in Cincinnati Ohio, and by Tetra Tech. EPA also stated that Tetra Tech submitted comments concerning RFV No. 1, but EPA requested additional information from SECOR, concerning RFV No. 1 (Bench Scale Test Results), be forwarded to the Land Remediation and Pollution Control Division.

EPA also stated that once all comments were received, EPA would make one comments' submittal. EPA stated that SVE system is no longer contingent upon the "Pilot Study". Chevron asked EPA for their data which led EPA to this discussion. EPA stated that due to the increased tar seep activity around the site and the appearance of several locations where gas has apparently caused "blow outs" on the side slope, this decision was made. Chevron asked EPA to submit their data, and if Chevron determines that EPA data supports the installation of the SVE system, Chevron will implement the SVE system. EPA recommended that all parties involved with the project conduct a round table discussion to address EPA's concerns regarding the implementation of the SVE system.

SECOR stated that they are reviewing the subgrade compaction data submitted by IT and were also evaluating the 100% Design, prepared by Smith, to determine reasoning behind compaction requirements for the subgrade. Chevron asked how the deficiencies with the subgrade

compaction data will be resolved. EPA stated that Tetra Tech and SECOR should discuss their independent evaluations and determine an amicable resolution.

**05/31/02 – SECOR's Conceptual Approach Submittal:**

SECOR submitted the Geo-technical Evaluation and Conceptual Approach to replace RFV No. 1. SECOR stated "the simplest method to prevent the tar boils from occurring is to neutralize, remove, or cover the sulfonated sludge so that no untreated sludge exists in the upper three feet of soil where it can be affected by solar heating. Neutralization and stabilization of the sludge in the side slopes was proposed by IT through the use of Portland Cement. SECOR recently proposed the use of quicklime as a more suitable reagent for stabilization and neutralization. However, EPA raised concerns of fugitive emissions associated with mixing of the materials".

"A more suitable method of addressing the sludge would involve covering the material with at least three feet of soil to eliminate solar heating of the sludge. The remedial design calls for placement of four feet of soil over the side slopes. This volume of soil is adequate to insulate the effects of solar heating. However, geotechnical mitigation measures for the side slopes may be required to compensate for soft spots in the side slope created by sludge located immediately below ground surface".

"To provide this additional level of safety, SECOR will place geotextile fabric on the subgrade slopes prior to construction of the foundation layer. The fabric will cover the slope from top to toe around the entire closure cover system footprint perimeter. The geotextile fabric will provide additional strength to the near-surface tarry sludge deposits in the side slopes, thereby mitigating localized settlement of the foundation layer, and eliminating the need for chemical stabilization, since slope stability will not be an issue".

**06/06/02 – EPA's Geo-technical Evaluation and Conceptual Construction Approach**

In regards to the slope solidification, EPA's position has not changed. EPA will not accept an alternative that recommends that nothing will be done to the perimeter slopes. Field construction has shown that the perimeter slopes cannot be compacted to the design specifications because that waste exposed on the perimeter slopes is the actual pit material that is made up of sludge, debris and soft material. EPA has already made a decision with ChevronTexaco and their previous contractor on how to handle the perimeter slopes; which was to solidify them.

**06/10/02 – EPA submitted Tetra Tech's review and comments for the Geo-technical Evaluation and Conceptual Approach submitted by SECOR on May 31, 2002.**

**06/17/02 – EPA's Geo-technical Evaluation and Conceptual Construction Approach letter:**

"In regards to the slope solidification, EPA's position has not changed. EPA will not accept an alternative that recommends that nothing will be done to the perimeter slopes. Field construction has shown that the perimeter slopes cannot be compacted to the design specifications because the waste exposed on the perimeter slopes is the actual pit material that is made up of sludge, debris and soft material. EPA has already made a decision with ChevronTexaco and their previous contractor on how to handle the perimeter slopes; which was to solidify them".



PCL XL error

Subsystem: USERSTREAM

Error: MissingData

Operator: 0x0

Position: 0

**DRAFT**  
**SOLIDIFICATION/STABILIZATION AND LIMESTONE ISSUES CHRONOLOGY**  
**PURITY OIL SALES SUPERFUND SITE**  
**FRESNO, CALIFORNIA**

Based on a preliminary file review of the Limestone Issues regarding the Bearing Capacity, pH, Limestone Installation and Slope Solidification/Stabilization Concerns, the Chronology are as follows:

**Bearing Capacity and pH:**

**11/9/94** – While reviewing the Pre-Design and Remedial Design Work Plan EPA asks the following question: “EPA presumes that the behavior of the Layer B material under the stress of the cap will be considered”.

**05/2/96** – While reviewing the Pre-Final Design (90%) text EPA asks the following question: “Please also see comment 20 in our letter to you dated December 14, 1995. We are not convinced that the designer has adequately considered for possible settlement of the waste pit material, especially due to significant voids that may surround the buried construction rubble. We are not convinced that compaction of the foundation layer will adequately compact the waste layer.”

The multiple “geo” layers require more detailing. One EPA expert with whom I consulted indicated that perhaps all layers should be carried through the “anchor trench”. Each section should provide a reference to where more details can be found.”

Smith’s response:

...”The flexible membrane liner and drainage layers cannot be continued throughout the anchor trench and down the slope of the cover because by doing so, we would be de-stabilizing the slope. By including the geosynthetics on the slope, we would be introducing a low friction resistant failure surface into the design which could lead to slope failures.”

**12/10/98 – Chevron’s Response Submittal** – Chevron submitted responses to comments on the Draft Remedial Action Workplans, dated August 5, 1998 and comments prepared by CH2M Hill on November 16, 1999.

EPA commented “that past data shows that waste has overflowed onto the boundaries of the trailer park and Bruno’s scrap yard. As a short term protective measure, DTSC installed gunite on the slopes between the trailer park and the Purity Oil Site during 1984. Waste material was on the exposed slopes prior to the implementation of the gunite.”

EPA also state that “during the 1984 Harding Lawson (contractors for DTSC) placed gunite over the slopes adjacent to the trailer park that had exposed oily waste (see Figure 1-8 in RI).

Waste extends more than five feet onto Bruno's property, due to past flooding. There is also a high probability that waste may be located at least five feet onto the trailer property. Chemical analyses indicate that the waste is high in lead and certain organic compounds. The pH of the tarry waste is as low as 1.9."

In addition, EPA stated that "along certain portions of the site, the maximum perimeter slopes will be 3(horizontal): 1(vertical) and will also be covered with a 3-inch thick reinforced concrete layer to minimize infiltration and prevent viscous materials from permeating through the closure system. Seeps have been occurring behind Trailer #7. Provide a description of how a 3-inch thick layer could still be protective and prevent infiltration. Maybe the thickness of the concrete layer should be increased on the slope areas.

**04/17/00 – Meeting with EPA (Rose Marie, Jim Sickles, Bill Mabey)**

Tetra Tech expressed concern for future site settlement.

Tetra Tech expressed concern for sludge seeps "ooze".

**05/10/00 – Meeting with Chevron, IT Corporation, EPA, and Tetra Tech**

EPA expressed concern over tar seep in Tall Trees Trailer Park, and that it has been occurring a decade or longer. (IT states approximately <1 liter/month)

EPA concerned about how much sludge remains within the site.

**05/24/00 – Meeting with EPA and IT Corporation**

EPA expressed concern over the tar seeps on the perimeter slopes and potential for future movement.

EPA also expressed concern over potential settlement of the cap and the side slopes ability to hold in the sludge/tar.

IT Corporation proposes to place a woven geotextile (Mirafi) over soft spots and areas that exhibit excessive pumping.

EPA asks if HDPE will react with acidic sludge and if HDPE will "keep sludge in".

**07/00 – Future Meeting (Status of Remedial Design Issues to be Discussed):**

Unresolved items such as Cap Integrity, Settlement Design, and Mitigation of Sludge Migration to be discussed.

**07/25/00 Meeting with EPA and IT Corporation**

EPA concerned about sludge movement

Discuss options for the following:

- Treatment
- Containment
- Absorbent
- Collection System

**07/25/00 – Memo** – An interoffice memo was prepared regarding the oozing oil along the perimeter slopes. It was concluded that the soil should be treated with some form of agent to immobilize the oil.

**07/28/00 – Memo** – As per EPA's request, Tetra Tech submitted a memo regarding actions proposed for Inclusion in Proposed ROD Amendment. The *Response to Comments from the May 24, 2000 Meeting, Draft Remedial Action Workplans* (RAWP) received from IT Group dated June 27, 2000 and notes from the meetings of May 24, 2000 and July 26, 2000 were reviewed to determine if there were any actions that should be considered in the proposed OU-2 ROD amendment. Based on the review there were significant issues addressed in the OU-2 soils remedy as currently proposed in the RAWP. One of the issues was the mitigation of potential migration of tarry sludge beyond the cap. Data from the remedial investigation and the remedial design investigation document the presence of tarry sludge with an in-place viscosity ranging from a free flowing liquid to a tarry viscous sludge. The concern was the vertical and lateral load of the planned cap. The cap will add some additional pressure on the sludge, which in turn may change the viscosity of the sludge, or the rate of gas-generating chemical reactions. Generated gas may in turn displace sludge out of void spaces in the soil thereby inducing sludge migration. To mitigate this migration, an exploratory trench was proposed along the north and south boundaries of the site in areas where sludge was encountered in the earlier investigations.

**08/1/00 Meeting with EPA and IT Corporation**

Concern about continued sludge/tar seeps on perimeter slopes  
EPA states "known seepage=known risk"

**10/31/00 – Foundation Layer Specification:**

Specification needs to provide bearing; bridge gaps and provide voids for viscous materials thereby reducing the potential for settling and permeation of viscous substances; and act as a gas vent permeable layer and not get plugged up by fines less than #100 sieve size.

**11/3/00 Project Meeting (Purity Site)**

Concern about continued sludge/tar seeps on perimeter slopes. IT Corporation proposes to install a woven geotextile over sludge/tar seeps.

**11/10/00 Project Meeting (Purity Site)**

Proposed foundation material testing is done except for CaCO<sub>3</sub> test and is expected to be submitted to TTEMI on 11/13. Looking at two area pits on the north and on the south sides of the site.

**11/17/00** – concern over presence of carbonate in soils which could result in subsidence and gas formation – recommended avoiding carbonate soils.

**11/30/00** – recommended that carbonate in soils be maximum of 5% with no contact between oily waste and foundation layer.

**12/1/00 Project Meeting (Purity Site)**

Concern about continued sludge/tar seeps on perimeter slopes. Proposal to over-excavate sludge/tar seeps and soft slope soils and backfill with foundation layer materials.

**12/8/00 Project Meeting (Purity Site)**

Concern about continued sludge/tar seeps on perimeter slopes. IT Corporation proposal to excavate sludge/tar seeps, place a woven geotextile, and backfill with foundation layer materials.

Concern that large pools of acidic sludge/tar remain within the site

Concern about the possible "wicking effects" that could occur with the woven geotextile and the acidic liquid.

Proposal for some type of "buttress" for the sludge/tar seeps

Proposal to install settlement monuments to determine if site is moving.

**12/15/00 Project Meeting (Purity Site)**

Concern about continued sludge/tar seeps on perimeter slopes.

Proposal to remove 1 foot of effect slope soils at toe of slope, place woven geotextile (Mirafi 600) then place foundation layer materials.

Compaction cannot achieve in areas where identifiable sludge/tar seeps are located.

concerned that sludge/tar seeps have a pH of approximately 1.

concerned about structural stability of north slope, discuss a "receptor trench" for the acidic liquids be installed at the toe of the north slope.

**12/29/00 – Revision to the RAWP (OU-2)** – EPA comment #17 – Provide a new figure to document that along the perimeter of the cap an anchor trench will be dug to the depth of known occurrences of waste based on Remedial Investigation and Remedial Design information available. Tetra Tech agreed with depths ranging from 2 to 4 feet below the perimeter lines. In that case, the cap may have to cross property boundaries or the waste brought back on site. Agreed Resolution – "Agreed".

**01/04/01 Project Meeting (Purity Site)**

IT Corporation will bring out Sunil Kishnani (PHD Civil Engineer) to look at perimeter slopes and present a recommendation to EPA to address EPA concerns.

EPA proposes excavating test pits in sludge/tar seep areas.

**03/20/01 Stop Work Letter**

EPA issued a Stop Work Letter to Chevron on March 20, 2001 that required Chevron to address several issues that were not in compliance with the "conditionally approved" RAWP.

**04/02/01 – IT's Slope Stability Analysis Submittal** – IT prepared a Slope Stability Analysis report on behalf of Chevron to report results associated with the design analysis of the soils operable unit. This slope stability analysis was conducted at the request of Tetra Tech EM Inc. in an email, dated February 28, 2001. The results gathered from this design analysis were used to evaluate the static and seismic stability of the most critical side slopes of the site as graded for closure and with the closure cover installed.

**05/9/01** – Expressed concern over low pH oil seeps and materials – GSE states that HDPE is good to pH of 1 but if below that it is of concern – suggested a 2 liner system with a drainage net between – GCL will fail if comes into contact with oily waste.

**05/21/01 – Evaluation of Submittal** – A meeting was held on May 21, 2001 at EPA Region IX Headquarters with Chevron, IT Corporation, EPA and Tetra Tech EMI to discuss the Purity Oil Sales Superfund site and STOP WORK letter issued on March 20, 2001. 7 major issues were discussed:

- (1) Golden State Market
- (2) Off-Property Contamination
- (3) Foundation Layer
- (4) Geosynthetic Components (Compatibility with Acidic Waste)
- (5) Re-design of site in relation to FID pipeline
- (6) Re-design of site in relation to BNSF railroad
- (7) SAP/QAPP for the installation of monitoring wells and SVE wells.

Chevron was asked to submit information to the EPA on items 3-7 by June 1, 2001. Items 1 & 2 require additional discussion between EPA and Chevron.

On June 5, 2001, IT submitted information on items 3-7.

**05/31/01 – Email** - IT sent an email to Serrot (Geosynthetic Manufacturer) and stated that “ A litmus paper test of the liquids next to some of the tars indicate a pH of 1 (or less). Is the HDPE compatible for this material?”

Serrot responded by submitting Serrot Technical Note - #9/HDPE Chemical Compatibility which stated that “Acids such as concentrated nitric, phosphoric or sulfuric acid are also oxidizers but different acids have different characteristics. The manufacturer should be consulted if a liner is going to be used in containing a solution with a pH of less than 2.

**05/31/01 – Memo** – IT sampled sludge and sent sludge samples to IT Technology Development Laboratory for Neutralization Treatability testing. IT Technology Development Laboratory tested the sludge with the following reagents:

<u>Reagent:</u>	<u>%/Weight:</u>	<u>pH:</u>
(1) Portland Cement	35% & 45%	10.16 & 10.82
(2) Limestone	40% & 50%	3.34 & 3.83
(3) Lime Kiln Dust	35% & 45%	11.06 & 11.59
(4) Cement Kiln Dust	35% & 45%	4.54 & 4.44
(5) Quicklime	20% & 30%	11.85 & 11.93
(6) Fly Ash (Class C)	35% & 45%	3.70 & 3.97
(7) Hydrated Lime	30% & 40%	7.24 & 9.80

As a result, IT Technology Laboratory recommended the use of limestone ( $\text{CaCO}_3$ ).

**06/05/01 – Evaluation of Submittal - Action Items based on IT's submittal regarding Liner and Acid Compatibility:**

- (1) Installation of the limestone on all slopes, at a minimum.
- (2) Submittal from Gas Collection Pipe manufacturer that demonstrates compatibility of materials with the sites acidic environment. (Pipe and Geotextile Sock)
- (3) Submittal from GCL manufacturer that demonstrates compatibility of material with sites acidic environment. (Bentonite & Geotextile)
- (4) Does the presence of Sulfur compounds in the acidic tarry waste when adding Limestone create SO<sub>2</sub> gases and can they impact (1) the effectiveness of the SVE system; (2) the integrity of the liner; (3) will the combination (is this exothermic?) with acidic vapors in other portions of the gas collection piping cause material compatibility problems; and (4) will the resulting changes from the acid with the limestone reduce the permeability of these layers and seal off the subgrade from the gas collection layer designed into the foundation layer.

**06/28/01 – Memo** – As requested by EPA, Tetra Tech submitted a memo "Evaluation of Two Submittals dated May 21, 2001 and June 5, 2001 in response to the stop work notice by U.S.EPA, dated March 20, 2001. The proposed action to address the incompatibility of the proposed HDPE liner with the low pH of the acidic tarry waste by using limestone to adjust that pH to a compatible level appears to be acceptable following the additional submittal of information addressing the compatibility of other materials that could potentially be in contact with the waste beneath the liner. These materials consist of (a) piping being used in the Soil Vapor Extraction (SVE) system and (b) the geosynthetic clay liner (GCL). In addition, an installation plan and specifications for the limestone should be provided.

**07/19/01 – Submittal** - Chevron submitted the response to the U.S. EPA's letter of July 5, 2001 stop work issues sent by J. Truskey to D. Rabbino. Chevron responded by:

- (a) "The bench tests performed by IT demonstrate that the application of the lime layer in selective locations will buffer the pH to above 2.5. The HDPE membrane liner is compatible with pH in this range. The piping for the horizontal wells will be HDPE, which has the same characteristics as the liner membrane material."
- (b) "IT will install Bentofix. A phone conversation with Mr. Graydon Renshaw of Serrot International, Inc. geosynthetic supplier for the Purity Oil project (800-323-3836), recommended using a special scrim reinforced GCL coated with a low permeability polypropylene membrane."
- (c) "The installation plan for the lime is to place with a loader a 4 to 6 inch layer of ½ inch limestone on the side slopes as necessary where low pH tar seeps are evident, and a strip 36 inches wide on the subgrade, immediately under the horizontal SVE horizontal pipes." It was then discussed that the term "as necessary" needs to be quantified as much as possible ahead of time.

A synopsis of this evaluation was presented to Chevron as a single-page punch list of key issues by EPA during a meeting on August 2, 2001.

#### **8/02/01 – Meeting**

Submittals required and subgrade work to be conducted was discussed.

IT to provide a revised schedule showing all remaining components of OU-2, including, the SVE system, eleven groundwater monitoring wells to be installed, rehabilitating the existing extraction wells, groundwater collection & treatment system operation, and a borrow source report for RMC.

Subgrade items such as the excavation of all contaminated material identified during the anchor trench excavation and the placement of limestone on the entire length of the northern, western, and southwestern slopes.

**9/12/01 – RFI Submittals** – RFI No. 24 (Changes to the Geosynthetic Liner Materials) and RFI No. 25 (Use of Geocomposite Layer for SVE System Collection) were submitted.

**09/19/01** – City of Fresno Complaint (Refer to 12/07/01 comments).

On September 19<sup>th</sup>, 2001, a customer visiting the Golden State Market notified the Fresno Community Health Service of noxious odors coming from the Purity Oil Sales Superfund Site. The customer complained of being nauseated and having throat irritation after being exposed to the noxious odors.

The Fresno County Fire Department's Hazardous Materials' Team and the Fresno Community Health Service were dispatched to the site to investigate the complaint. Rose Marie Caraway (EPA) was also notified of the incident by the Fresno Community Health Service. The Fresno County Fire Department's Hazardous Materials' Team monitored the area, prior to entering the site, for combustible constituents and for Sulphur Dioxide.

After the initiation of engineering controls (odor suppressant) to mitigate any future emissions from the site, by IT Corporation, the Fresno Community Health Service and Fresno County Hazardous Materials' Team left the Purity Oil site.

The source of the odors was found to be the acidic tar that was discovered in the Perimeter Exploratory Anchor trench.

**09/26/01** – EPA provided SECOR with written approval for RFI No. 24, 25 and 26. The written approval for RFI No. 26 clearly stated, "If anomalous low strength materials are discovered during construction, the stability analysis should be reevaluated". Secondly, this approval suggested that the project should include a geotechnical oversight program to verify that the parameters that IT assumed in their design were accurate.

**10/04/01** – A large area of acidic tar was discovered at the toe of the north slope, adjacent to the Purity Oil, Tall Trees Trailer Park, and Golden State Market property lines. The acidic tar extended into the Tall Trees Trailer Park, which was observed during the Perimeter Exploratory Anchor Trench excavation. Video documentation of this area was performed by EPA and Tetra Tech.



**10/07/01 – Tetra Tech EMI Memo to EPA** – To achieve the elevations and grades depicted on Drawing 7A included as part of RFI No. 26, several tar seeps have appeared at the toe of the North Slope during excavation activities (Pictures were taken on this date). As part of Tetra Tech's letter to SECOR on September 26, 2001, "Review of RFI No.'s 24, 25 (Rev. 2) and 26", Tetra Tech stated that, "If anomalous low strength materials are discovered during construction, the stability analysis should be reevaluated".

**10/10/01** – On October 10, 2001, Tetra Tech issued a letter to SECOR regarding the stability of the north slope due to the consistent appearance of tar seeps ("anomalous low strength material"). The slope stability analysis presented in RFI No. 26, utilized unit weights for the cover system, waste layer, and subsurface layers of 115 pounds per cubic foot (pcf), 107 pcf and 106 pcf, respectively. The unit weight of the waste layer utilized in the slope stability analysis differed from the unit weight of 71.8 pcf, determined by IT's Technology Development Laboratory in the "Bench Neutralization Test of the Tar Seep Material from the Purity Oil Site," which was performed in May 2001. Because of the vastly differing unit weights of the waste layer, EPA questioned the validity of IT slope stability analysis.

**10/15/01** – IT's Quality Assurance Engineer, Dr. Sunil Kishnani, P.E., requested that test pits be excavated into the slopes, around the entire site. These test pits clearly identified large volumes of debris and that tarry waste was present.

**10/17/01 – Project Meeting** – EPA, Tetra Tech, SECOR and IT discussed utilizing lime as a solidification agent for the soft areas on the perimeter slopes. IT's QA engineer stated that this procedure would tighten up the soft spots on the perimeter slopes and eliminate the need to test the perimeter slopes.

The EPA asked IT to submit a detailed solidification/stabilization procedure. The EPA requested that the procedure include the following: (1) areas requiring solidification/stabilization, (2) How deep each grid will be treated, (3) debris removal procedure i.e. material that will be removed and debris that will remain, (4) mix design, and (5) QA/QC procedures. Once the procedure is approved, a treatment demonstration will be conducted on some of the worst areas.

**10/23/01 - Slope Solidification/Stabilization Concerns:**

IT proposes quicklime and pilot test.

IT proposed the Perimeter Slope Subgrade Solidification Procedure based on discussions between representatives of EPA, Tetra Tech, SECOR (10/17/01 only), and IT Corporation, on October 15 and 17, 2001. Also, as discussed in IT's proposal, "The presence of soft tarry waste, contaminated soil material, iron, steel, and large concrete construction debris in the subgrade, "soft" spots have been observed on the subgrade of the perimeter slopes. In addition, due to the presence of these materials, it has been difficult to accurately test the compaction of the subgrade."

**10/24/01 – RFI Submittal** – IT submitted RFI No. 27 (Proposed Change in Subgrade Specifications) and RFI No. 28 (Perimeter Slope Subgrade Solidification Procedure). The Slope Solidification Procedure was proposed because IT was unable to meet the compaction

requirements (all excavations and fill materials of the subgrade layer), as required by the project specifications, for the perimeter slopes.

**10/25/01 – Treatment Demonstration with Quicklime** – IT and their earthwork subcontractor conducted a treatment demonstration, utilizing Quicklime, on three grids that contain soft areas on the North Slope.

During the treatment demonstration, a release of dust and steam formed a cloud, with a height of 100 to 125 feet which left the Purity Oil Sales Superfund Site. IT Corporation notified the adjacent property owner (Bruno's) to notify them that it was steam and was not of any concern. At approximately 12:45 p.m. a second release was observed and once again left the site towards Bruno's.

Shortly after the second release, Randy Tosi (Bruno's) came to the site and complained about material settling on his site and that he was also concerned about the safety of his workers.

On October 29<sup>th</sup> an employee of Bruno's Scrap Yard complained of having respiratory type problems over the week-end. EPA contacted the IT Group and required them to ensure that the employee received appropriate medical care that was caused by the October 25<sup>th</sup> release. Refer to 10/29/01 for further detail.

**10/29/01 – Bruno's Scrap Yard Employee Complaint** – Tetra Tech was contacted by EPA that an employee working at the Bruno's Iron and Metal yard located north of Purity was complaining of medical symptoms that the employee attributed to exposure to the dust and fumes associated with the solidification/stabilization activities performed at Purity on October 25, 2001. Representatives of Tetra Tech and SECOR went to Bruno's and met with Mr. Randy Tosi. Mr. Tosi stated that one of his employees was complaining of symptoms that he attributed to the inhalation of the dust and fumes coming from Purity on October 25, 2001. Mr. Tosi was also concerned with the "white dust" on some of his scrap metal, and was also concerned with his customers.

#### **11/01/01 – Project Meeting and Submittals:**

IT and SECOR also submitted the following information on November 1, 2001; (1) Summary of Field Plot Solidification Tests (2) Corrective Action for subgrade solidification procedures. Also, on November 1, 2001, EPA, Tetra Tech, SECOR and IT discussed the slope solidification procedures. The EPA was concerned about emissions from the lime mixing. IT suggested Portland Cement as an alternative to lime. Based on the discussion, IT was to prepare a new solidification procedure using Portland Cement slurry as the reagent as recommended by Mr. Paul Lear of IT, and (3) Valley Industrial & Family Medical Group incident report for a Bruno employee.

**11/01/01 – Memo** - Tetra Tech prepared a memo documenting the cleared future well locations. A brown bubbling liquid was observed from CIX-7. Cross-sections and photographs of the subsurface conditions observed while excavating the future well locations have been filed.

**11/07/01 – Project Meeting** – An on-site meeting was held between IT, SECOR and Tetra Tech to observe the excavation of the test pits in the north and west slopes and for IT to propose a subgrade solidification procedure.

**11/08/01 – IT and SECOR Submittal** – IT and SECOR submitted the Perimeter Slope Subgrade Solidification Procedure.

**11/13 and 11/14/01 – IT Submittals** – The proposed Supplemental Air Monitoring Approach and the Perimeter Subgrade Solidification Procedure were submitted.

**11/19/01** – IT submitted a revised Slope Solidification Procedure based on the discussions held during the meeting conducted on November 15, 2001. Tetra Tech then forwarded the revised procedure via fax to EPA on November 20, 2001. Tetra Tech informed IT that the Contingency plan was required as part of the Slope Solidification Procedure before night activities could begin, and a Supplemental Air Monitoring Plan would be required if IT elected to work during the day. Both plans would have to be approved by EPA before Slope Solidification activities could commence. A revised response was not submitted by IT to EPA and Tetra Tech during the 11/19-11/25/01 reporting period regarding the two plans.

**11/26/01** – IT submitted the Perimeter Slope Subgrade Solidification Procedure.

**11/27/01** – IT submitted the Perimeter Slope Subgrade Solidification Emergency Response Plan and Contingency Procedures which was required as part of the 11/26/01 submittal before field work can commence. Also, according to IT, on November 27, 2001, Technicon tested the compaction of the subgrade on top of the site from the center point to the west and all of the tests passed.

**11/28/01 – IT's Perimeter Slope Subgrade Solidification Procedure:**

Tetra Tech (Purity Site) received the Perimeter Slope Subgrade Solidification Procedure (issued on November 19, 2001) and a conference call was conducted between EPA, Tetra Tech and IT on November 20, 2001.

Based on discussions between representatives of EPA, Tetra Tech, SECOR and IT, on November 1, 8 and 15, 2001, the following procedure was developed to address the presence of seeps.

The procedure will be verified, and, if necessary, modified depending on the results of the test. The test will be in-situ mixing area directly on the slope, where the Portland Cement slurry will be mixed into the soft material. Full grids will be selected to facilitate management of the test.

**11/29/01 – EPA's comments to the Perimeter Slope Solidification & Contingency Procedure:**

EPA submitted comments to IT regarding the Perimeter Slope Solidification Procedure, the Perimeter Slope Subgrade Solidification Emergency Response Plan and Contingency

Procedures, a table entitled "Action Levels Established for Excavation/Handling of Petroleum Contaminated Soil" and the Slope Solidification Log.

**12/05/01 – IT's RFI No. 28, Rev. 1 Submittal regarding the Perimeter Slope Subgrade Solidification Procedure:**

IT submitted RFI No. 28, Rev. 1 based on EPA's comments on 11/29/01. RFI No. 28, Rev. 1 was developed and submitted to address the solidification of soft areas on the perimeter slope. In addition, this procedure addresses the presence of seeps.

**12/07/01** – SECOR met with the City of Fresno to inform him of the Slope Solidification and Stabilization activities to be conducted at night and also provided air monitoring data collected on September 19, 2001. Also, Tetra Tech and EPA held a conference call to discuss RFI No. 28.

**12/13/01 – EPA's comments to RFI No. 28, Rev. 1:**

EPA submitted comments to SECOR (subcontractor authorized, on behalf of Chevron) regarding the Perimeter Slope Solidification & Contingency Procedures. EPA requested that IT should incorporate the comments and submit as RFI No. 28 Rev. 2 for EPA review. SECOR also submitted the revised Public Notice on this date.

**12/17/01 – IT's RFI No. 28, Rev. 2 and Rev.3 Submittals:**

IT submitted RFI No. 28, Rev. 2 and Rev.3 to address EPA's comments from RFI No. 28, Rev.1 submitted on December 13, 2001. After numerous meetings, and numerous changes to the slope solidification procedures, and reagents, due to IT's (Chevron's subcontractor) inability to handle the reactions and fugitive emissions, SECOR, on behalf of Chevron, submitted RFI No. 28, Rev. 3. RFI No. 28, Rev. 3, utilized Portland Cement slurry instead of quicklime, to try and control the heat of reaction and the fugitive emissions.

IT stated that the presence of soft tarry waste, contaminated soil, iron, steel, wood, and large concrete created "soft" spots in the subgrade of the perimeter slope. When the subgrade was tested for compaction using compaction tests defined in the QA/QC table of the RAWP, it failed. The diverse nature of these subgrade materials made it difficult to accurately test the compaction of the subgrade using the defined compaction test methods.

**12/27/01 – EPA's Approval of RFI No. 28, Rev. 3:**

EPA submitted the approval of RFI No. 28, Rev. 3, Proposed Perimeter Slope Subgrade Solidification Procedure, to SECOR.

**01/10/02** – Tetra Tech was notified by IT that the Perimeter Slope Solidification/Stabilization field activities will not begin due to their on going financial problems.

**01/14/02** – SECOR submitted Limestone Placement (Memo 115) to replace Memo No. 106.

**01/16/02** – IT filed for Chapter 11 Bankruptcy Protection.

**01/17/02** – Tetra Tech received the compaction data for the exploratory trench backfill and the subgrade construction.

**01/25/02** – Tetra Tech sent an email to IT regarding the subgrade compaction data, requesting information not provided by IT in their January 17, 2002 submittal package. A meeting had been scheduled for January 29, 2002 to discuss Compaction Data.

**01/29/02** – Tetra Tech met with IT at the site to review and discuss the January 17, 2001 cover letter and table submitted along with the subgrade compaction data.

**01/31/02** – Tetra Tech met with EPA at the site to review and discuss the Subgrade Compaction Data (Initial Evaluation).

**02/11/02** – IT hand delivered copies of the subgrade compaction field sheets to Tetra Tech's San Francisco office which were not legible in the January 17, 2002 submittal package. However, after review of the February 11, 2002, submittal package, there were still field sheets which were not legible.

**02/13/02** – EPA and Tetra Tech conducted a meeting (San Francisco office), to review the Initial Evaluation of the Subgrade Compaction Data and the current site status.

**02/24/02** – Tetra Tech contacted IT and informed them that the subgrade compaction testing data (field copies) was still not legible and requested that legible copies be provided. SECOR was also informed during this time regarding this data.

**03/13/02** – EPA submitted a letter to Chevron to hire a new subcontractor.

**03/15/02** – EPA sent an email regarding a meeting to be held with EPA, Chevron, and possibly Tetra Tech and SECOR.

**03/22/02** – SECOR met with Tetra Tech to discuss the remedies for Purity and also conducted a site walk to help assist SECOR's proposal to be submitted to Chevron.

**03/26/02** – Tetra Tech contacted SECOR and informed them of the Geosynthetic requirements (RFI's 24, 25 and 26).

**03/29/02** – ChevronTexaco, SECOR and Tetra Tech conducted a site walk and discussed the tasks to be completed.

**04/18/02 – Project Meeting/Conference Call:**

SECOR stated that they will be conducting the site work in accordance with the 100% Design, Project Specifications, Remedial Action Work Plan, Consent Decree, and Approved RFI's submitted by IT Corporation. SECOR requested that the RFI's be change to RFV's. SECOR to submit RFV's to address (1) Slope Solidification/Stabilization (2) Horizontal and Vertical Tolerances during construction and (3) Pilot Study. SECOR asked about the compaction data. Tetra Tech asked SECOR if they had reviewed that data. SECOR stated "No". Tetra Tech once

again asked SECOR to review the data so that EPA, Tetra Tech and SECOR could discuss a course of action.

**04/23/02 – SECOR's RFV No. 1 Submittal/Perimeter Slope Solidification Procedure (RFI No. 28, Rev. 3):**

“SECOR requested a variance to the Perimeter Slope Subgrade Procedure as presented in RFI No. 28, Rev.3, which was submitted by IT and subsequently approved by EPA. As no previous requirement exists in the CD, 100% Final Design or SOW, SECOR has reviewed all available information generated by the previous contractor, which includes the following documents: RFI No. 28; RFI No. 28, Rev. 1; RFI No. 28, Rev. 2; RFI No. 28, Rev. 3, EPA comments which address these documents, and a summary of the previous contractor's attempts to stabilize the slopes”.

“In evaluating the Portland Cement Stabilization method, SECOR has found evidence that this method will not be effective at the Purity Site. An EPA demonstration using Portland Cement for stabilization of acidic petroleum sludges at the Douglassville Superfund Site in Pennsylvania failed to adequately stabilize the sludge and the ROD was changed to allow for quicklime stabilization. The Portland Cement method attempts to stabilize sludge by creating micro-cementation, which produces a temporary strength for undisturbed sludge, but the sludge will turn flowable when mixed or disturbed. Therefore, SECOR evaluated using quicklime to stabilize the Purity sludge. Quicklime treatment works by chemical stabilization reactions as opposed to micro-cementation bridges that are destroyed when agitated. Quicklime treatment has been used successfully by SECOR at other sites for the stabilization of petroleum-impacted soils and sludges”.

“Upon becoming the supervising contractor, SECOR conducted bench-scale tests to evaluate quicklime as a stabilizing agent that would address the concerns associated with this task, specifically, establishing a surface capable of supporting the closure cover, reducing the acidic nature of the tarry waste to help eliminate impacts to the liner materials, and limiting the mobility of the waste materials”.

**04/25/02 – Tetra Tech Memo** – As ambient air temperatures continue to increase, several tar seeps have surface on the north slope. A site map illustrating the approximate position of these tar seeps, and a set of digital photographs which documents the location and size of the tar seeps on this date were recorded and filed.

**05/02/02 – EPA Evaluation of Perimeter Slope Solidification & Contingency Procedures:**

EPA submitted comments to RFV No. 1 and requested that SECOR incorporate the comments and submit as RFV No. 1, Rev. No.1. The objective was to determine if SECOR's request meets/or exceeds the approved IT's perimeter slope solidification procedure (RFI No.28, Rev.3).

EPA also mentioned in this letter that the they will not approve the initiation of placement of the foundation layer until the following items are completed (1) the slope stabilization is completed and approved by EPA for all effected grids and (2) all applicable compaction test data (including

previous and outstanding test data) for the top and sides of the cap have been submitted, evaluated and approved by EPA.

**05/08/02 – Project Meeting (Purity Site):**

EPA, Tetra Tech and SECOR were present during this site meeting. EPA informed SECOR that a through review of RFV No. 1 was underway at this time. EPA has contacted the Remedial Project Manager of the Douglassville Superfund Site in Douglassville, PA. and has identified several discrepancies with SECOR's proposed approach and the remedial action that was implemented at the Douglassville site. The discrepancies identified thus far are: (1) Lime Kiln Dust was utilized at the Douglassville site, not quicklime, and (2) Portland Cement was never considered as a reagent for the Douglassville site.

SECOR asked EPA if they want to use cement slurry as previously proposed by IT in RFI No. 28, rev.3. EPA stated that they are not concerned about the reagents, but is more concerned about the approach. EPA also stated that when work is performed, the EPA wants it to be a permanent fix. In addition, EPA stated that, at a minimum, 2 feet on the south slope would require stabilization and 3 feet on the north and west slope would require stabilization.

EPA also stated that all perimeter slopes will require treatment, not just areas where visible sludge is identified, as stated in RFV No. 1. SECOR stated that they were going to use any reagent necessary (i.e. sand), not necessarily quicklime, to get slopes to meet compaction. EPA stated that since compaction was not achievable on the perimeter slopes, treatment of all perimeter slopes is required, once an acceptable approach has been agreed upon.

**05/13/02 – Project Meeting (Purity Site):**

EPA, Chevron, Tetra Tech and SECOR were present during this site meeting. Chevron asked EPA if RFV No. 1 was being reviewed by EPA and their subcontractor (Tetra Tech). EPA stated that RFV No. 1 was being reviewed by EPA Land Remediation and Pollution Control Division, in Cincinnati Ohio, and by Tetra Tech. EPA also stated that Tetra Tech submitted comments concerning RFV No. 1, but EPA requested additional information from SECOR, concerning RFV No. 1 (Bench Scale Test Results), be forwarded to the Land Remediation and Pollution Control Division.

EPA also stated that once all comments were received, EPA would make one comments' submittal. EPA stated that SVE system is no longer contingent upon the "Pilot Study". Chevron asked EPA for their data which led EPA to this discussion. EPA stated that due to the increased tar seep activity around the site and the appearance of several locations where gas has apparently caused "blow outs" on the side slope, this decision was made. Chevron asked EPA to submit their data, and if Chevron determines that EPA data supports the installation of the SVE system, Chevron will implement the SVE system. EPA recommended that all parties involved with the project conduct a round table discussion to address EPA's concerns regarding the implementation of the SVE system.

SECOR stated that they are reviewing the subgrade compaction data submitted by IT and were also evaluating the 100% Design, prepared by Smith, to determine reasoning behind compaction requirements for the subgrade. Chevron asked how the deficiencies with the subgrade

compaction data will be resolved. EPA stated that Tetra Tech and SECOR should discuss their independent evaluations and determine an amicable resolution.

**05/31/02 – SECOR’s Conceptual Approach Submittal:**

SECOR submitted the Geo-technical Evaluation and Conceptual Approach to replace RFV No. 1. SECOR stated “the simplest method to prevent the tar boils from occurring is to neutralize, remove, or cover the sulfonated sludge so that no untreated sludge exists in the upper three feet of soil where it can be affected by solar heating. Neutralization and stabilization of the sludge in the side slopes was proposed by IT through the use of Portland Cement. SECOR recently proposed the use of quicklime as a more suitable reagent for stabilization and neutralization. However, EPA raised concerns of fugitive emissions associated with mixing of the materials”.

“A more suitable method of addressing the sludge would involve covering the material with at least three feet of soil to eliminate solar heating of the sludge. The remedial design calls for placement of four feet of soil over the side slopes. This volume of soil is adequate to insulate the effects of solar heating. However, geotechnical mitigation measures for the side slopes may be required to compensate for soft spots in the side slope created by sludge located immediately below ground surface”.

“To provide this additional level of safety, SECOR will place geotextile fabric on the subgrade slopes prior to construction of the foundation layer. The fabric will cover the slope from top to toe around the entire closure cover system footprint perimeter. The geotextile fabric will provide additional strength to the near-surface tarry sludge deposits in the side slopes, thereby mitigating localized settlement of the foundation layer, and eliminating the need for chemical stabilization, since slope stability will not be an issue”.

**06/06/02 – EPA’s Geo-technical Evaluation and Conceptual Construction Approach**

In regards to the slope solidification, EPA’s position has not changed. EPA will not accept an alternative that recommends that nothing will be done to the perimeter slopes. Field construction has shown that the perimeter slopes cannot be compacted to the design specifications because that waste exposed on the perimeter slopes is the actual pit material that is made up of sludge, debris and soft material. EPA has already made a decision with ChevronTexaco and their previous contractor on how to handle the perimeter slopes; which was to solidify them.

**06/10/02 – EPA submitted Tetra Tech’s review and comments for the Geo-technical Evaluation and Conceptual Approach submitted by SECOR on May 31, 2002.**

**06/17/02 – EPA’s Geo-technical Evaluation and Conceptual Construction Approach letter:**

“In regards to the slope solidification, EPA’s position has not changed. EPA will not accept an alternative that recommends that nothing will be done to the perimeter slopes. Field construction has shown that the perimeter slopes cannot be compacted to the design specifications because the waste exposed on the perimeter slopes is the actual pit material that is made up of sludge, debris and soft material. EPA has already made a decision with ChevronTexaco and their previous contractor on how to handle the perimeter slopes; which was to solidify them”.



"In regards to the evaluation of the requirements for the subgrade compaction, EPA is not willing to eliminate that requirement based on the argument. The purpose of the requirement for compaction of the subgrade was to ensure that the remedy would be properly constructed on the Purity Oil property. The failure of ChevronTexaco's previous contractor to construct the subgrade in a manner that would meet the design specifications does not justify the elimination of this requirement. Previous data shows that the compaction results have failed to meet the design specifications".

**06/19/02 – Project Meeting** – A conference call was held between EPA, Tetra Tech and SECOR regarding the Conceptual Approach (EPA Response Submittal, June 17, 2002). EPA stated that there were 2 assumptions with regards to the slope stabilization/solidification process which was (1) debris, concrete, waste material, etc... contained within the side slopes, and (2) compaction of the side slopes. As a result, EPA stated that the Smith designers were hired by the PRP's and their design may vary from the current field conditions.

**06/27/02 – North Slope Exploratory Excavation**

SECOR excavated the west end of the north slope (Grid B) to determine extent of tar seeps. SECOR utilizes an infrared temperature gun to record temperature of excavation.

Excavation is approximately 3-5 feet deep. Black soil with tar and misc. debris was encountered in excavation.

SECOR backfills excavation with soil from Minnewawa pit. Backfill was compacted in lifts and tested as it was being placed.

**06/28/02 – Conference Call**

EPA and Tetra Tech hold a conference call to discuss North Slope Exploratory Excavation conducted by SECOR on 06/27/02.

EPA representative from Office of Research and Development (Ed Bates) will mobilize to Purity site on July 9, 2002 to observe tar seeps and to determine potential alternatives.

**07/09/02 – Test Pit Excavation/Project Meeting (Purity Site):**

SECOR excavated six test pits to verify the existence of acidic tar within the Purity Oil site. The top four feet of the test pits were fairly uniform with a mixture of sand, bricks, concrete, metal, wood, and soil to approximately six feet below ground surface.

At approximately six feet below ground surface, soft black soil mixed with tar pockets, sludge, and a brown liquid was encountered. These materials were fairly uniform to a depth of approximately ten to twelve feet below ground surface.

Below approximately ten to twelve feet, no more tar pockets or brown liquid was encountered.

**07/10/02 – Meeting to discuss Test Pit Excavations**

EPA, Tetra Tech, and SECOR held a meeting to discuss the findings of the test pits excavated on 7/9/02, and to discuss potential alternatives to acidic tar and sludge.

**07/11/02** – EPA submitted Draft comments for the RAWP, CQCP, H&SP and Perimeter Air Monitoring and Sampling Plan Addendums

**08/02/02** – SECOR Submitted Backup Slope Stability Assessment Information/Geotechnical Evaluation and Conceptual Construction Approach.

**08/27/02 Project Meeting**

A Project Meeting was held at EPA Region IX (EPA and Tetra Tech EMI) to discuss the 7 Alternatives and to prepare for a meeting with ChevronTexaco and SECOR on August 28, 2002.

**08/28/02 Project Meeting**

A Project Meeting was held at EPA Region IX, with EPA, ChevronTexaco, Tetra Tech EMI, and SECOR. The purpose of the meeting was to present the 7 Alternatives, which would address the acidic tar seeps, to ChevronTexaco and SECOR.

ChevronTexaco requested some time to review EPA and Tetra Tech's presentation, and that they would provide the EPA with some preliminary feed back in approximately one week.

A second meeting to discuss the 7 Alternatives was scheduled for October 3, 2002.

**09/01/02** – An informal meeting was held between EPA, Tetra Tech and SECOR to discuss the 7 Alternatives presented on August 28, 2002.

**09/13/02** – Conference call with EPA, Tetra Tech, and SECOR to discuss Alternatives 2, 4, and 7. SECOR asked several questions regarding the implementation of Alternatives 2,4, and 7.

**09/18/02** – Conference call with EPA Office of Research and Development (Edward Bates) to discuss questions SECOR raised in regards to the implementation of Alternatives 2,4, and 7.

**09/25/02** – Meeting held between EPA and ChevronTexaco to discuss the 7 Alternatives presented on August 28, 2002. ChevronTexaco informs EPA that they would like to implement Alternative 7 (Stabilization of the entire site).

### **Limestone Installation:**

**05/21/01** - Meeting to go over stop work issues – concern expressed over foundation soils ability to meet needs of bearing; act as venting for gas; and barrier to sludge to protect liner.

**05/21/01** – IT submits memo from Paul Lear suggesting that bench scale test recommends use of limestone for full scale neutralization – we feel that it should be installed over entire site (side slopes).

**06/6/01** – Asked Paul Lear if SO<sub>2</sub> would be released if acidic waste contacted Limestone and also would it affect the piping.

**06/7/01** – Paul Lear responds that he would still use ½" limestone since it would reduce the exothermic reaction and generation of SO<sub>2</sub>.

**06/15/01** – IT recommended use of limestone to protect the liner and to address the compatibility of the piping and GCL.

**07/13/01** – IT responds they would use limestone to raise pH above 2.5 and then would protect liner and proposed use of GCL with a scrim – would use limestone for the side slopes with 4 to 6 inches of ½" limestone under tarry seeps and in a band 36" under the SVE piping (note EPA says to put over all of the slopes due to uncertainty of seeps).

**08/2/01** – IT agreed to put limestone over all of north, west, and southwest slopes and will provide installation plan.

**08/16/01** – EPA says ok to proposed approach.

**08/23/01** - Rick Sugarek questions the effectiveness of limestone due to being blinded by oils and formation of gypsum scale.

**08/27/01** – Paul Lear responds that this would be more of a concern in low viscosity oil rather than with the high viscosity oils at Purity Oil and still recommends limestone – states that Portland cement would set up and provide strength but could force movement to edges with seepage at edges and joints.

**08/29/01** – Rick Sugarek still has concerns over scaling and preferential pathways through the limestone to toe of slope.

**10/17/01 – Project Meeting** – EPA, Tetra Tech, SECOR and IT discussed utilizing lime as a solidification agent for the soft areas on the perimeter slopes. IT's QA engineer stated that this procedure would tighten up the soft spots on the perimeter slopes and eliminate the need to test the perimeter slopes. Because quicklime was utilized as part of IT's Bench Scale Treatability Study, IT's QC engineer stated that the quicklime would serve the same purpose as the limestone "buffering agent" for the acidic tar which would protect the liner and proposed GCL with a

propylene membrane backing. Solidification of the soft areas would also be accomplished by the addition of the quicklime.

The EPA asked IT to submit a detailed solidification/stabilization procedure. The EPA requested that the procedure include the following: (1) areas requiring solidification/stabilization, (2) How deep each grid will be treated, (3) debris removal procedure i.e. material that will be removed and debris that will remain, (4) mix design, and (5) QA/QC procedures. Once the procedure is approved, a treatment demonstration will be conducted on some of the worst areas.

**12/11/01** - Tetra Tech assumes that IT is not going to use limestone under the slopes stabilized by Portland cement and is requesting a limestone installation plan.

**12/11/01** – EPA response is that the approach of no limestone under the stabilized slopes may be ok but we may want to see how it goes in the Portland Cement stabilization pilot and if it is necessary still require limestone.